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A STUDY OF THE EFFECTS OF DIFFERENT SCORING
PLANS ON STUDENT PERFORMANCE IN AN
ELEMENTARY ACCOUNTING COURSE

A dissertation Presented

By

RONALD B. PAWLICZEK

Submitted to the Graduate School of the
University of Massachusetts in partial
fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

April

1975

Major Subject: Business Administration

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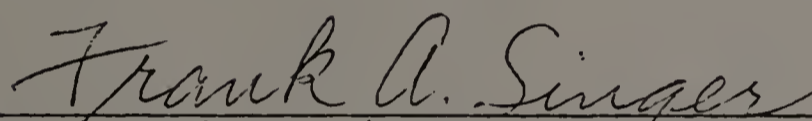
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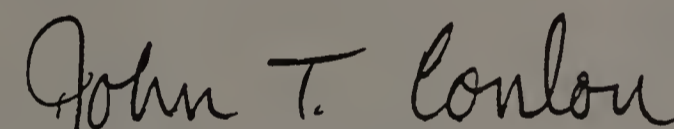
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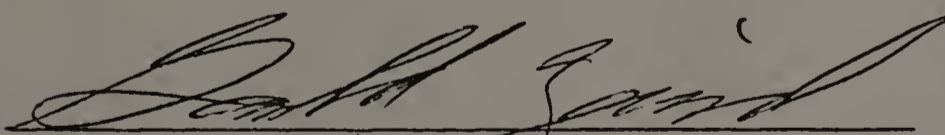
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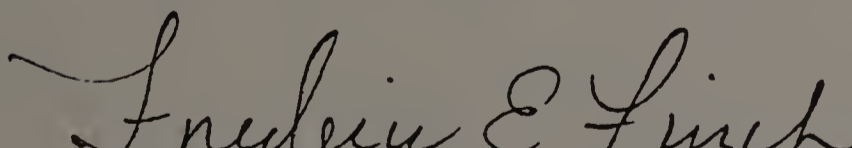
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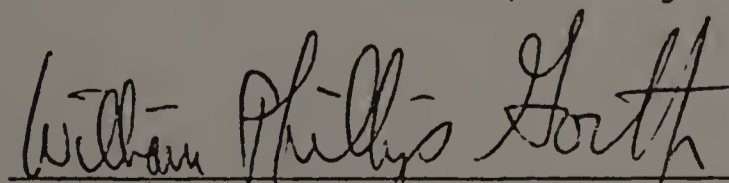
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A STUDY OF THE EFFECTS OF DIFFERENT SCORING
PLANS ON STUDENT PERFORMANCE IN AN
ELEMENTARY ACCOUNTING COURSE

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Abstract

Purpose. This study will show that grading is an important variable affecting student performance and that a teacher's selection of a particular grading plan affects the amount his students learn. It will be argued that the teacher should be guided by the behavior he wishes reinforced in his selection of a specific grading plan.

Research issues. In this study two different grading plans were evaluated. The plans differed in the size of the response which would be awarded credit. In one plan, the test score was increased for correct responses to units no smaller than the transaction, a single business event. In contrast, the other plan, allowing partial credit, gave some score when portions of a defective transaction record matched a correct solution--even though there are no occasions when accountants are called on to record less than an entire transaction. Both plans are used commonly. It can be argued that the plan which allows partial credit is mis-

leading to the student, sending a message that he has learned adequately when he has not because he is given some credit for responses which show that he has not mastered concepts necessary for later learning. On the other hand, the no partial credit plan requires the response to be correct in its entirety before any credit is given.

Method. The study involved teaching two sections of students in an elementary accounting course in the same way, but consistently scoring their examinations and other work by different rules. The percentage marks reported to the students were not interpreted. The treatment which was expected to produce the more favorable response was assigned to the group with the lower aptitude as measured by the AICPA Orientation Test. After six weeks a post-test was administered and the equality of the group means was tested using a "t" test. The post-test was also item analyzed to determine whether any differences in performance applied to a few items or to many, and to discover if one treatment produced better performance on a particular type of item.

A regression analysis was completed because three students withdrew from one group and none withdrew from the other. This analysis addresses the question of whether different treatments are equally or differentially effective for students of similar aptitude. The frequency of a particularly significant type of defect was tallied and compared.

For the remainder of the semester all students (with the exception of five) were graded according to the plan which was associated with the higher scores on the post-test. For five tests including the final examination the mean scores of the two groups were computed and compared. A severe test of the power of the treatment applied the less effective teaching method to five specially selected students.

Results. The data analysis shows that the grading plan which allowed no partial credit resulted in higher student performance than the grading plan which allowed partial credit. Comparison of median and mean scores, the regression analysis, and the frequency count of two types of "impossible answers" all show a regular and impressive advantage for the no partial credit grading plan. Analysis of the final examination shows that the group originally graded according to the less effective method had recovered and that their performance approximated that of the group consistently graded according to the more effective method.

Conclusions. The research study has shown that a specific grading plan allowing no partial credit resulted in higher student performance in an elementary accounting course than a specific grading plan allowing partial credit. There is support for the conclusion that, through their grading decisions, many teachers inadvertently have been choosing less, rather than more, learning for their students. The differ-

ence was expected because of the differing reinforcement characteristics of the two plans. It might also be concluded that such a difference would be found not only in an accounting course, but in any course where the subject matter is of a cumulative nature.

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C H A P T E R I

LEARNING THEORY AND GRADING METHODOLOGY

Various grading practices. If several different accounting teachers were given the same examination paper to grade and were asked to explain how they graded the paper and why they had chosen their particular method, the following answers might be representative. One teacher says that he divides each test into a large number of response elements and gives a point for each element answered correctly. Several others who say the same thing each choose a different set of elements. Another teacher divides every test into ten parts and gives ten points for each part answered correctly and a fraction thereof for each "partially correct" part. Both the division of the examination into parts and the assignment of partial credit are often quite capricious.

Asked if his method is the only correct method of grading, each teacher probably answers, "No," saying that grading is necessarily arbitrary and that any method preferred by a teacher is acceptable. Another teacher says that the grading method should provide as much encouragement as possible. Students need to feel encouraged and should be given the highest possible score consistent with their relative performance. This teacher would want to see all the papers in a set and choose his grading criteria to achieve high

marks. All of these teachers have in common their willingness to give some credit to students who have not carried out task instructions.

Most of these teachers have not contemplated the possibility that the grading plan used may affect student performance, and others have considered this possibility and rejected it. The obvious exception is the teacher concerned with giving maximum credit so as to give maximum encouragement. However, he is not relating encouragement to specific learning results, and it may be argued that his analysis is superficial.

These other teachers do not consider any grading plan to be the "right" one and for this reason can be influenced by such things as a method of grading used by one of their former teachers, the convenience of a particular assignment of points, or subtle pressure from students in their choice of a grading plan. For instance, a teacher can be induced into using a plan which enables most students to obtain high marks simply because he dislikes student complaints, and students achieving high marks are less likely to complain. Conscious bribery is not suggested. Such an inducement can be so subtle that the teacher is unaware that he has been influenced.

In contrast, two teachers would strongly disagree with the foregoing attitudes and practices. One of them, not representative of the majority of teachers, regards the

grade as much more than a means of evaluation by teachers. His opinion is that grading is teaching because grades are a consequence of great significance to most students, indicating whether or not they have performed satisfactorily and thereby affecting their learning. This teacher will modify his grading according to the effects which it appears to have on students and he will explicitly look for these effects. (This is in contrast to the teacher who gives maximum credit without having analyzed its effect.) Even before administering a test, the teacher concerned with grades as a consequence will have examined the test and will have made a judicious assessment of the probable effect, thereby eliminating any unnecessary experimentation. Such a teacher has utilized behavioral analysis in devising his grading plan and awards credit on examinations only when the student evidences behavior of importance (e.g., conceptual learning) and withholds credit for unwanted performance. For him, not granting partial credit is crucial so as to reduce the risk of some students perceiving as acceptable performance which will not enable them to continue to learn effectively. This teacher will try not to make exceptions because he recognizes that:

The likelihood of doing this -- suspending the laws of behavior temporarily -- is roughly the same as suspending the laws of gravity. The laws work all the time: One may not notice them or do anything but struggle with them, but they are working.¹

This teacher bases his grading plan on its consequences, having looked at how different plans influenced the students and having chosen the plan that had the favorable effect.

The second of these dissenting teachers bases his grading plan on his personal judgment of what is worthwhile, fundamentally an ethical decision. He contends that credit should be given only when a student has shown mastery of a meaningful unit of learning. While it is possible that in some cases his definition of a meaningful unit might cause him to use the same grading rules as the teacher who bases his grading plan on its consequences, his determination is not empirically based and would not be changed even if he were shown results contrary to his opinion. Obviously, these two teachers will not always be in agreement. Only the teacher who bases his grading plan on its consequences, because he recognizes the grade as a significant outcome of the student's performance and considers the grade given as likely to influence future performance, has made an analysis of behavior in terms of reinforcement theory.

Reinforcement theory. Learning is doing something new or doing something with increased speed. When a performance is followed by a particular stimulus and the performance is repeated with increased frequency, the performance is said to have been reinforced by that stimulus. The stimulus could be an event or a condition, including the organism's own behavior. Thus, when a bird pecks and is given food, it is very likely that he will peck again; and when a child

picks a pint of blueberries and is given a dollar for them, the probability of his going berry picking again increases.*

It should be noted that all learning theorists do not subscribe to a reinforcement theory point of view. Theories presently proposed range from the simplest contiguity theory (what a person does is what he learns) to cognitive learning theories which emphasize the intellectual processes of human beings and focus on individual goals and objectives.² Some theorists would contend that these theories can be combined; the theories are not mutually exclusive and learning by human beings occurs because of the individual's motivation as well as the perceived reward. However, there are other theorists who are unwilling to explain learning in terms of motivation theory. While some of these theorists recognize that something else besides the perceived reward may have to be present for learning to occur, they are not convinced that this other factor is motivation.

In any case, it is difficult to measure motivation and in many cases to affect it. However, the effect of varying feedback can be ascertained more easily and the effect of varying feedback is investigated in this study. The following cases illustrate how reinforcement can be used to modify behavior.

*Technically, the probability of his offering blueberries for sale is increased. It is an assumption that he will acquire them in the same way. It is the act which the stimulus follows which is reinforced.

Ferster and Perrott report on two cases in which reinforcement was systematically applied in the classroom. In one case a boy emitted undesirable classroom behavior (kicking, screaming, crying, etc.) with high frequency. When he behaved in this manner, a group of staff members invariably gathered around him and watched. This attention reinforced his tantrums. The experimenter had the boy placed at his desk kicking and screaming, and the experimenter sat at her desk and ignored him. After two or three minutes the boy looked up. The experimenter said she would be ready to work with him as soon as he was ready. For the next five minutes he cried with diminishing loudness. Then, he lifted his head and stated he was ready. The experimenter looked up at him, smiled, went to his desk, and started to work with him. Each time a tantrum occurred, the experimenter ignored the boy. When the tantrum stopped, the experimenter conversed with the boy, went close to him, and initiated an activity he enjoyed. After several weeks the classroom tantrum behavior disappeared.³

In the other case a boy's spelling of words which he previously had studied but which he had been unwilling to spell, was improved by withholding teacher attention until the child correctly spelled the word on the blackboard. Undesirable behavior was ignored and within a month the frequency of bizarre spelling decreased.⁴

As Homme and Tosti point out, reinforcement is functioning to influence behavior whether or not it is being used systematically. Several cases are described by Semmelroth in which behavior can be explained as the consequence of unplanned reinforcement.

In the same way that consequences administered by the "real physical world" regulate much of our behavior, consequences administered by other people also regulate our behavior. When an employee produces a sub-standard product and he is "paid" for it, he continues to produce substandard products (perhaps at a greater rate). When a secretary's delay in typing a letter "results" in not having to type it at all (it was typed by someone else, or the boss decided it shouldn't be sent after all), then she will tend to delay all of her work. When an airline ticket agent's smile and greeting to a customer is met with "The sign says 'express check-in'. I've been waiting half an hour," he tends to smile less.

In these three examples, the behaviors are regulated by consequences which are "under the control" of other people. The employee's sub-standard performance is regulated by its consequences which are in fact made up of the behavior of his foreman, perhaps his fellow workers, and the payroll office. Similarly, the secretary's delay and the ticket agent's smile are "paid off" by consequences which are under the control of others around them.⁵

All of the foregoing illustrations fit these rules:

1. Behavior is the product of its consequences.
2. The consequences are what the organism perceives them to be -- not what an experimenter intends.
3. While it is often possible to guess whether a given consequence will be reinforcing, it is possible to err. Therefore, one must observe

closely and modify original expectations in the light of data.

The teacher and behavior regulation. When Semmelroth says that consequences administered by other people regulate behavior, the teacher-student relationship immediately comes to mind. The teacher regularly provides feedback to the student, and if the student's substandard performance is rewarded, it is likely he will react just as the employee did when he was paid for substandard work. It is, however, difficult to determine whether or not a particular grade will be satisfactory to a particular student because students' aspirations vary so greatly. For example, take the case of two students who received identical scores of 75% on an examination for which 60% had been defined as the minimum passing grade. The first student had failed all previous examinations and believed a grade of 75% indicated that he was making real progress. On the other hand, the second student wanted to make the Dean's List and found a grade of 75% to be most unsatisfactory because it lowered his quality point average below the Dean's List standard.

There are many other reasons why different students respond in different ways to the same grade. A second example might be the case of two students both of whom showed understanding of four out of six concepts when responding to a series of examination items. The first student was very satisfied feeling that he had mastered a majority of the

concepts. However, the second student desired complete concept mastery and was very bothered by the misunderstandings that remained. Although the teacher can not know what grade will be perceived as satisfactory by every student, he can choose what to label as unsatisfactory. Obviously, a non-passing grade is not rewarding to any student. If the teacher gives credit when the concepts have not been mastered, he runs the risk of reinforcing some students when they still have not learned enough to deal successfully with later material.

Scott, Dornbusch, Bushing, and Laing present a conception of authority "based on the process by which performance evaluations of organizational participants are made."⁶ They believe their conception to be a useful descriptive and analytic tool limited in scope only by the following conditions:

1. Organizational sanctions are distributed, at least in part on the basis of evaluations made of participants.
2. Evaluators who influence the distribution or organizational sanctions attempt to base their evaluations, at least in part, on the performance of organizational tasks by participants.
3. Participants place some value on the evaluations of their task performance made by these evaluators.⁷

The first criterion excludes any organization where performance evaluation either is not carried out or does not influence sanction distribution. The second condition eliminates

organizations where evaluations are not based on performance in organizational tasks. The third condition requires that those evaluated place some value on the sanctions. Scott et. al. believe that these conditions are not very limiting, and it is possible to see that while the stated conception is applicable to a business organization, it is applicable in other settings also, for example, in the classroom involving the teacher-student relationship. The formulated definition is abstract enough to be applicable in different settings, but specific enough to guide the gathering of empirical data. It might seem then that teachers of accounting because of their concern with evaluating the performance of their students would attempt to analyze grades for their effects on student performance.

The study reported in the following chapters will be concerned with grading practices that many teachers of accounting are using. It is surprising to note that they seem to use methods based on reinforcement theory no more frequently than they use other approaches. In most cases they do not use the results criterion in choosing a grading plan. This lack of concern with results is surprising because management control reporting is an important accounting topic, and the essence of management control reporting is results.

Management control reporting. Just as management, through its accounting system, sends a report because it desires a particular response by subordinates, it would seem

logical that a teacher might give a grade in hopes that it would influence a student either to continue or to change his behavior. In any management control system the appropriate method is the one that sends the message that secures the desired response. The significance of this emphasis on results is illustrated in Robert Anthony's well-known Management Accounting. He indicates that management behavior is more important than what its reports "say." Anthony says, "Action is a sure signal, probably the only effective signal, that management is interested in the control system. Basically, this action involves praise or reward for good performance, criticism of or removal of the causes for poor performance."⁸ It is perfectly possible either to undermine a message with apparent indifference or to act so as to emphasize one part of the message at the expense of others. He illustrates using the example of the variety of messages that can be sent to the foreman with regard to the allocation of maintenance costs which are

...partly the responsibility of the maintenance department, which incurs costs when it makes repairs or does other maintenance work; and it is partly the responsibility of the operating department foreman, who can influence the amount of required maintenance work, by how well he takes care of his equipment.

As Anthony says:

There are at least a dozen ways in which the costs of the maintenance department can be charged to the several operating departments, and each gives a different "message" to the foremen as to how they should view their responsibility for maintenance.¹⁰

Anthony continues by saying that no one method of allocation is in itself better than other methods.¹¹ In selecting a method, the best method is the one that motivates the foreman to act as management wants the foreman to act. A supervisor should look at the actual results and select the method or methods that will produce the results he desires. Unless the subordinate sees action on the part of the superior with respect to performance taking place in the organization, he has reason to assume that management is satisfied with existing performance.

Grading and management control reporting. The parallels between management control reporting and grading of students by teachers seem clear. Just as the quality of control reporting depends on its effectiveness in influencing subordinates in an intended way, it can be inferred that the quality of a grading plan is dependent upon its effectiveness in fostering student learning. Obviously the teacher wants his students to learn the principles and concepts presented in the course. In a course like accounting he particularly does not want to waste his time trying to teach students who still lack prerequisite skills. If the management control report sends a message that performance is satisfactory when, in fact, it is not, subordinates are unlikely to change. If the grading plan being used allows the student to achieve a satisfactory grade without having learned enough, the student may see no reason to perform better even though what he

has learned is really inadequate. It would seem that a grading method which gives credit to responses which are imperfect runs a greater risk of promoting substandard performance than one which does not.

However, it is not possible to be certain, by inspection, that the plans differ significantly (even though it is strongly suspected). Therefore, this study was designed to investigate the consequences of some specific grading practices. One plan, not infrequently used, is representative of a type that appeals to teachers who seem not to consider the learning consequences in making their choice of a grading plan. On the other hand, the second plan is one, which, if the behavioral analysis is correct, may be expected to promote more learning. The primary objectives of the study is to decide whether or not teachers are making grading choices which have a pronounced handicapping effect on their students.*

A sample examination. Figure 1 is a student's actual response to part of an examination administered at the beginning of the second semester of accounting. The teachers involved could not agree on a set of rules for grading and each, therefore, graded according to his own set of rules.

*Of course, no contention is being made that the best plan has been identified. However, if it can be shown that a significantly better plan exists, then the use of the plan to which it was compared is certainly handicapping in this case, as it would be if compared to the best plan.

A Sample Examination

Question Stem	Required: Indicate the actual effect (both before and after closing) of the following independent errors on each of the accounting elements described in the column headings below.						
	Error	Net Income	Total Revenue	Total Expenses	Total Assets	Total Liabilities	Total Owners' Equity
Example Responses	A failure to record an investment by an owner.	0	0	0	-	0	-
Test Responses	Case 1 Failure to record a sale of a service.	-	-	X	-	0	-
	Case 2 Revenue is credited when cash is collected from a credit customer.	+	+	0	+	0	+
	Case 3 Failure to adjust prepaid expense so it remains overstated.	X	X	-	X	X	X
	Case 4 No adjusting entry was made to record accrued salary payable.	+	X	-	0	-	0

Note: An X indicates an incorrect response.

These two different sets of rules are representative of the two treatments to be used in the study. On the examination, the student is being asked to apply the concepts of assets and liabilities, and owners' equity. The example requires the student to be able to discriminate among different classes of accounts and to relate the concepts in responding to the task posed.

The first teacher's grading method. One teacher scored the above examination by computing the percentage of cells with correct responses. Under this plan the student receives a score of $66\frac{2}{3}\%$ for this part of the examination since 16 of his cells matched the cells of a perfect solution. This is a frequent practice in accounting courses. However, since each cell is part of an equation (either total assets - total liabilities = owners' equity or revenue - expense = net income), it is a "partial credit" method in a significant sense.

The teacher using this plan is representative of those teachers who use partial credit plans. When such a plan is used, equations are not considered a totality but rather each is divided into three cells. When a student can answer two cells correctly of the three which comprise the equation and still receive credit (or even the one cell expected by chance), the grading plan seems to be rewarding performance which subsequently can be very damaging to the student in view of the cumulative nature of accounting. In accounting

it can be argued that the equation is the smallest significant unit because the student must be able to maintain equations and must continually make use of these equations in analyzing later topics. Unless there is an understanding of and an ability to work with these equations, the possibility of the student's mastering later material is very small.

For example, to the right of the double vertical line in Case 4 the student's response indicates an inability to apply the balance sheet equation. No set of facts could exist which would allow the student to change the equation on one side of the equal sign and not on the other as he has done. Regardless, under this plan the student receives credit for the two cells which agree with the correct response.

Upon closer investigation of this plan, for the student to obtain a 66-2/3% score, it is necessary only that he produce correct responses for two of the four transactions. If the responses in these twelve cells are arrived at because he recalled a similar case on an earlier examination or homework assignment, the additional four cells would most likely be arrived at by guessing, since there are only three possible choices and twelve chances to arrive at four correct responses.

Under this partial credit plan if a 60% score is defined as passing, a student is being told that his performance is above the minimum criterion. This being the case,

the message is one which many students will treat as a signal that they understand well enough and should continue in the same manner. Under this plan, because credit is given for responses that partially agree with the correct response to the relationship, there is a risk that some students' lack of understanding of the complete relationship will be reinforced by this credit when significant errors exist and improvement is still needed. Because much of accounting is cumulative, it is necessary that students be able to use previously studied concepts to succeed with later material. If the student can not use the relationships being studied, he will not learn later material which depends on them. Of course, there is little else.

The second teacher's grading method. The above examination could be graded in a number of other ways. The second teacher's method gives credit only when the student gives a response that has all parts of the net income definition correct or when he correctly supplies the entire balance sheet equation. Such a method is a choice motivated by its expected learning consequences. It would be chosen by a teacher who realizes that it is counterproductive to reward students who, when asked for an equation, produce a non-equation. He would do so because future performance can only be correct when equations are maintained, although it has been noted that an ethical motive might generate the same plan. In the illustration, the student answered one

of the four revenue-expense-profit relationships (Case 2) and two of the four balance sheet relationships (Cases 1 and 2) correctly. This score is 37-1/2%. A 37-1/2% score is unlikely to be reinforcing to any student unless specifically defined as a passing grade.

Summary

Some necessary goals of an accounting course are the learning of concepts (the ability to generalize across a class while still being able to discriminate among different classes) and principles (relationships between concepts) that relate to this discipline. In an introductory accounting course the student must certainly master the concepts of assets and liabilities and revenue and expense. However, the latter two concepts are subordinate to the concept owners' equity which is also a principle in that it is defined as a relationship between assets and liabilities. The mastery of these concepts and principles is crucial because later learning of accounting is dependent upon them. Therefore, it is clearly essential that the student not view his performance as acceptable until he has shown mastery of these concepts and principles. Giving credit for each cell seems to provide the wrong signal.

The study described in the following chapters investigated whether or not significant differences in results followed when two different grading plans were employed. It is

assumed that significantly higher test scores associated with one plan justify the rejection of the plan with the inferior results.

Footnotes

¹Lloyd Homme and Donald Tosti, Behavior Technology: Motivation and Contingency Management, Student's Manual (Individual Learning Systems, Inc., 1971), p. 49.

²J.J. Willingham, I.E. McNeill, E.F. Collins, "Learning Theories and Accounting," in James Don Edwards, ed., Accounting Education: Problems and Prospects (American Accounting Association, 1974), pp. 173-5.

³C.B. Ferster and Mary Carol Perrott, Behavior Principles (Appleton-Century-Crofts, 1968), pp. 146-7.

⁴Ibid.

⁵Carl Semmelroth, "The Regulation of Behavior by the Behavior of Others," NSPI Journal (October, 1970), p. 10.

⁶Richard Scott, Sanford M. Dornbusch, Bruce C. Bushing, and James D. Laing, "Organizational Evaluation and Authority," Administrative Science Quarterly (Fall, 1967), p. 94.

⁷Ibid.

⁸Robert N. Anthony, Management Accounting, 4th ed. (Richard D. Irwin, Inc., 1970), p. 422.

⁹Ibid., p. 421.

¹⁰Ibid.

¹¹Ibid., p. 422.

C H A P T E R II

DESIGN OF THE EXPERIMENT

Overview of the experiment. The experiment involved the teaching of two sections of students in an elementary accounting course in the same way, but consistently grading their examinations and other work in different ways. After six weeks a post-test was administered and the equality of group means (of four part scores and their total) was tested using a "t" test. The post-test was also item analyzed to determine whether any differences in performance applied to a few items or to many, and to discover if one treatment produced better performance on a particular type of item. Because it was not possible to have students randomly assigned to the treatment groups, the AICPA Orientation Test, Form D was administered to all students. The results of this test revealed that the aptitudes of the two groups differed more than would have been anticipated. Because of this difference, the treatment which was expected to produce the more favorable response was assigned to the group with the lower aptitude. A regression analysis was completed because three students withdrew from one group and none withdrew from the other. This analysis addresses the question of whether different treatments are equally or differentially effective for students of similar aptitude. A tally of the frequency of a particularly significant type of defect was made.

For the remainder of the semester all students (with the exception of five) were graded according to the plan which had caused higher scores on the post-test. Data were again collected and analyzed. A severe test of the power of the treatment, which applied the less effective teaching method to five specially selected students, was attempted. A log was kept of those students in the two experimental groups who sought individual aid of the instructor. The events of the semester are summarized in Figure 2.

The two grading methods. The two grading methods in this study are practices derived from contrasting philosophies described in Chapter I. In addition to the sample already given in Chapter I consider the test item sample given in Figure 3. Assume that a student analyzed the transaction as shown.

Of course, there is no set of factors which would allow the student to respond as he did to the transaction in Figure 3. His response indicates that he has not used the basic accounting equation ($\text{Assets} - \text{Liabilities} = \text{Owners' Equity}$) in responding to the transaction. Even if it were true that there are two \$200 asset increases, his equation still is not complete. Obviously, the correct response for Consulting Fees would have been "+80" in the revenue column.

The partial credit plan. Even though the student analyzed the transaction incorrectly, under the first of the

Figure 2
Time Line of the Events of the Semester

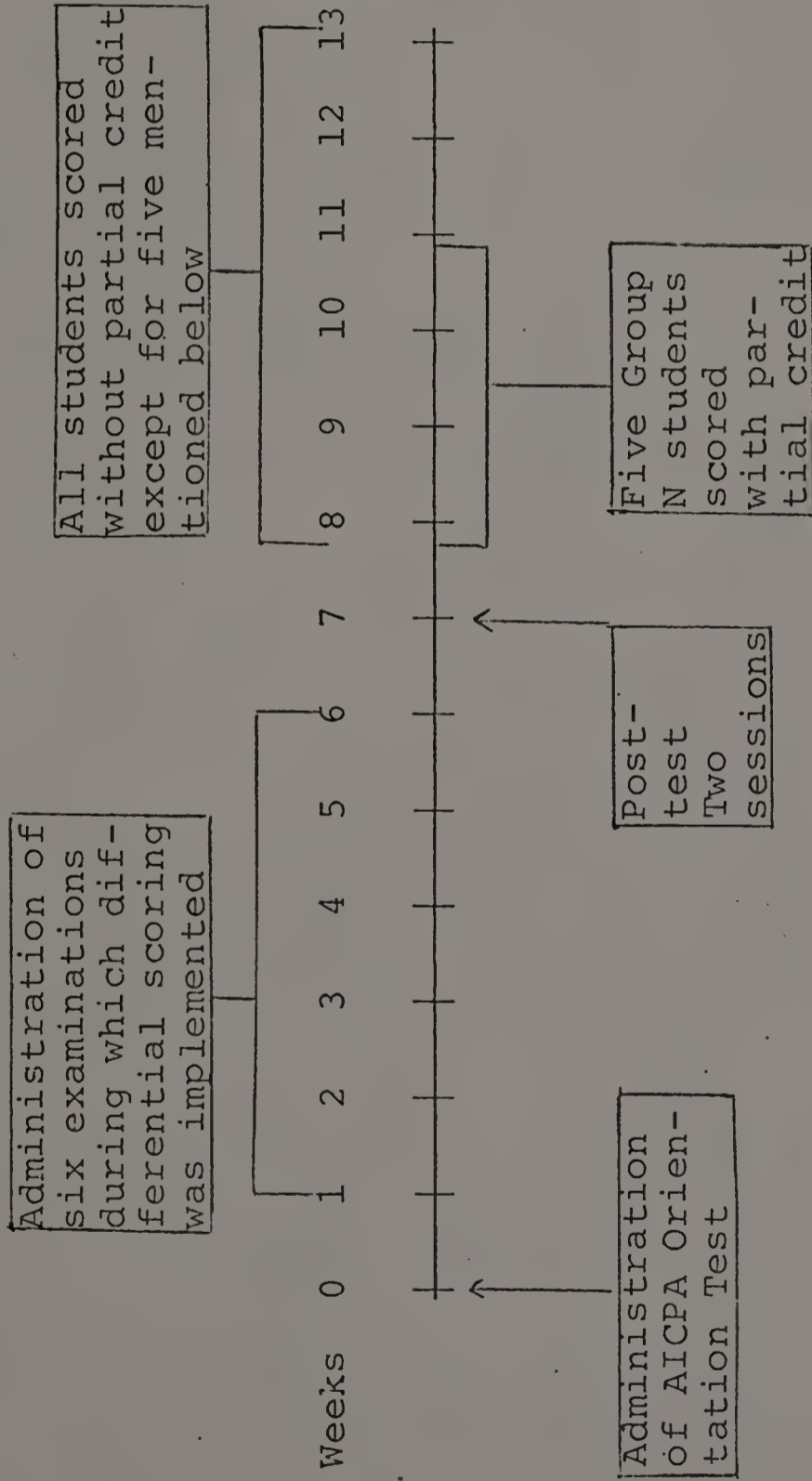


Figure 3

An Example of the Grading Methods

Question Stem	<p>Case 3: Received a \$200 payment in full for consulting services. \$120 related to services performed, recorded, and billed last month, while the remainder related to services performed (but not previously recorded or billed) this month.</p>			
Answer Sheet and Response	<p>Account Title</p> <hr/> <p>2. Cash</p>	<p>Total Assets</p> <hr/> <p>+200</p>	<p>Total Liabilities</p> <hr/>	<p>Owners' Equity</p> <hr/> <p>Revenue</p> <hr/> <p>or Income</p> <hr/> <p>Expense</p> <hr/> <p>Capital</p>
	<p>Accounts Rec.</p>	<p>-120</p>		
	<p>Consulting Fees</p>	<p>+200</p>		

grading plans, Partial Credit (PC), he would receive two points out of a possible three because two of the three lines were answered correctly. Partial credit is given under the PC plan when part of the student's response agrees with the correct answer. The grading practice is as follows. Each transaction is divided into parts and the student receives a point for each part answered correctly. In this plan a part has been established to be an account and its corresponding amount of change, although in some grading plans accounts and amounts are treated separately.

The no partial credit plan. The No Partial Credit (NPC) grading plan assigns a zero score to the response in Figure 3. Credit is given under NPC grading only when the student's response to a transaction is to analyze or record it correctly. The student must respond appropriately to all portions of the given transaction to obtain any credit. The partially right portion of a partially wrong transaction is not regarded as a meaningful unit of achievement and receives no credit.

It is probable that the two grading methods to be compared send different messages to some students, as discussed in Chapter I. In this example, this is especially true if a $66\frac{2}{3}\%$ score is defined as a passing grade. When PC grading is used, a student for whom the example is representative is given a signal that his performance is acceptable which may

end his effort to improve; while under NPC grading the lack of any credit unmistakably indicates the need for improvement. Under the NPC plan the message is that a denial of the basic equation always detracts as much or more than any recognition of asset or liability changes. The likelihood that the student will learn and use the "owners' equity" concept (a precondition of learning the "revenue" subset of this category) is enhanced by the NPC message.

Experimental design. The subjects for this experiment were the students in two sections of an elementary accounting course at a small, private, fully accredited four-year college. The students had been assigned arbitrarily to sections on registration day. The students were primarily freshmen majors in the School of Business. None had been enrolled previously in a college-level accounting course. Each section met with the instructor for three fifty minute periods each week and with a laboratory assistant (the two graders alternately) for one fifty minute common examination period. The instructor is the author of this study. Since the students could not be assigned randomly to sections, the AICPA Orientation Test, Form D, was administered to all students as a measure of their aptitude. The individual's performance on this test is an objective indication of his abilities in the verbal and mathematical areas. Training and experience beyond the high school level have only a moderate effect on

scores.¹ This test was given on the second day of the semester. As mentioned, the group whose mean score was lower on this test was assigned NPC grading. This was a deliberate attempt to bias the experiment against the NPC plan.

In all future discussions the group scored under PC grading prior to the ~~post~~-test will be referred to as Group P and the group scored under NPC grading prior to the post-test will be referred to as Group N.

The initial enrollment in the course was 66 students: 35 students in one section and 31 students in the other. At post-test time 35 students remained in Group P and 28 students remained in Group N. Of the three students who withdrew from the course in the NPC group, two withdrew after the second examination and the third withdrew after the third examination. None had seen more than one of his scored examinations.

During the scheduled class periods the instructor used his customary, conventional, teaching style, lecturing on material in assigned chapters and illustrating the solutions to problems assigned for homework. The text used in the course was Principles of Accounting by Johnson and Gentry.² The first eleven chapters with the exception of chapter six were the assigned material for the semester. An overall description of the textbook's content appears in Appendix A.

Each student assistant was assigned one of the sections and was given specific grading instructions for scoring ex-

aminations. No comments other than X's on the incorrect parts of the items and a percentage mark appeared on the examination papers. (However, correct solutions of the tests could be inspected by students when they turned in their own solutions.) The investigator reviewed a sample of each set of examinations to verify that the graders were grading appropriately. As mentioned earlier, a total of six examinations were given at weekly intervals during which there were two different scoring plans used. The first six examinations along with the scoring instructions which were used appear in Appendix B.

The behavioral objectives for the first six examinations, which, along with the tests themselves, were prepared prior to the start of the course, appear in Appendix C. Behavioral objectives are statements which describe what students should be able to do after completing a prescribed unit of instruction.³

Examination retention. In order to reduce the probability of students becoming aware of the different treatments being employed, each section was given its scored examinations for review during its next regularly assigned class period. The investigator demonstrated the correct solution to each examination task during this class, answered questions, and re-collected the examinations at the end of the class period. The examinations were kept in individual student folders, and the students in both sections were informed

that any further questions concerning the examinations would be answered during the investigator's office hours.

The investigator recognizes that the retention of examination papers by the instructor is not a typical procedure in an accounting course. However, the procedure may have a beneficial effect in that:

- (1) the student is more apt to pay careful attention to the mistakes he made and to the correct solutions to the problems during the classroom review because he will not have his paper for later review;
- (2) it encourages the student to ask questions of the instructor immediately since it is more burdensome to seek clarification at a later time.

The procedure, nevertheless, has some drawbacks in that:

- (1) given the individual differences of students, the time devoted to examination review in class is probably not sufficient for every student to understand the concepts being reviewed;
- (2) the students do not have their examinations available at all times for study and review, and they may not come to the office to compensate.

Overall, it would seem that the student is being given the opportunity to discover his mistakes and to ask questions of the instructor about those items which he may not have un-

derstood because of the immediacy of the availability of the solutions and the classroom discussion following. Also, many students would readily admit that, although they carry their papers away with the best of intentions, they often do not study them carefully. By reviewing the examinations in detail during class time, the use of feedback was promoted. Since the examinations were scheduled at weekly intervals, there was a period of time reasonably long for students to seek the investigator's aid if they had questions about any particular item. Their knowledge that another examination was soon scheduled also probably contributed to more attention to feedback. On balance, the investigator believes that the arrangements certainly were not disadvantageous to the students and may very well have been advantageous to many students.

Three homework assignments were collected during this part of the experiment. These homework assignments, which were textbook problems, were scored by the student assistants using rules which were consistent with the grading of tests in each section. Since these homework assignments were returned and not re-collected, a comparison of scores using a common grading plan is not possible.

The post-test and its analysis. During the seventh week of the course a four-part post-test (Appendix D) was administered to both sections at two consecutive laboratory meetings.

Parts I and II were given one week after the completion of examination 6 and Parts III and IV two days later. The formats of Parts I and IV were similar to the formats of examinations 3 and 5 respectively. That is, on Part I the student was asked to analyze a number of business transactions on a form similar to the form used on examination 3. On Part IV the student was required to enter account titles and balances in a segregated ledger and to record new business transactions in that ledger. The formats of Parts II and III, on the other hand, were new; although these portions tested previously studied principles and concepts. The behavioral objectives of the post-test also appear in Appendix D.

For analytical purposes the post-tests of all students were scored according to both grading plans. The results of the post-test were analyzed in three ways. First, a comparison of results was made using a "t" test to determine whether there was a statistically significant difference between the mean scores of the two groups.* A comparison was

* In testing whether there is a significant difference between two sample means when the universal standard deviation is not known, a "t" test may be used. If the sample sets are sufficiently large, the sample standard deviations may be calculated and are good estimates of the standard deviations of the universe. The data in this study fulfilled these requirements and therefore the "t" test was used.

The experimenter is aware that the use of the "t" test normally requires a random assignment from an infinite population. However, in this experiment the researcher used two groups of students assigned by the Registrar. It was decided to act as if these groups plausibly were a random sample from a hypothetical population to which it was (continued next page)

made between the total post-test scores with each part weighted equally. Comparisons were made also between the two groups' performance on each of the four parts of the post-test and on each item in the test. This analysis was completed twice, once with the scores from each grading plan.

Second, because there had been attrition in only one group, causing an uncertain effect on mean scores, a regression analysis was completed.⁶ This analysis shows how the treatments affected a given level of aptitude, a comparison which is not influenced by attrition rates. Each of the four parts of the post-test as scored under the NPC grading plan was regressed on the aptitude scores as determined by the AICPA Orientation Test.**

Third, a calculation was made of the percentage frequency of a particularly significant type of defect made by each group on Parts II and III of the post-test. The question being investigated is whether or not the student's answers show

wished to generalize. This logic has the endorsement of several top-level mathematical statisticians.⁴

The experimenter has defined the experimental unit and the unit of statistical analysis as the student. Potentially there is the danger that the individual students have not responded to the instruction independently and that the analysis of the experiment that uses the student as the unit of statistical analysis is illegitimate. However, methodologists have long sanctioned such actions.⁵

** Only NPC grading was utilized, but similar results would be expected should PC grading be used.

comprehension of the principles and concepts being examined and whether or not he has mastered the fundamentals necessary for further learning. (A discussion of these defects, "impossible answers," precedes the tallies in Chapter III.)

The analysis of the post-test was the first time in the experiment that group results were compared. The scores obtained using the NPC method were those reported to the students because of the demonstrated superiority of NPC grading based on the data analysis discussed in Chapter III.

Experiment viewed as a baseline design. A baseline design experiment involves the collection of data on the entry characteristics and/or the behavior of the subjects prior to the implementation of a treatment of interest. During the application of the treatment data are collected and compared to the pre-experimental data. A desirable feature of a baseline design is a reversal during which the pre-experimental condition is reinstated and then the treatment of interest is again applied.

After a period of scoring under different plans, because it was demonstrated that the NPC method produced significantly higher results than the PC method, both treatment groups, with the exception of five students in treatment Group N, were graded according to the NPC plan. This was not a typical baseline design experiment. However, the orientation test and the first examination can be viewed as an abbreviated baseline, because they predict future behavior in the absence of a treat-

ment. The scoring of Group P according to PC grading is a substantial period of consistent treatment which can be evaluated in relation to Group N's performance. This "baseline" is not one of no treatment as is usual in a baseline design, but it is instead a period of consistent different treatment.

For treatment Group N there was only the abbreviated baseline period, that being the orientation test and examination one up to the point in time when reporting the test scores began the differentiation of feedback. From that point on, the treatment of interest (NPC grading) was applied to Group N. NPC grading is the treatment of interest because it was associated with the better performance, not because the outcome was anticipated.

Throughout the period during which there is different treatment (in this experiment examinations two through six), the group to which the treatment of interest is applied (Group N, it turned out) is designated to be the one that has performed fairly consistently above the group to which it is not applied (Group P). After Group P is switched to the treatment of interest, if the treatments fairly explain the performances, their performance should come to resemble that of Group N, at least more nearly.

The cumulative median scores of treatment Groups P and N (using NPC scores) were graphed throughout the semester. Both a discussion of this graph and an analysis of the results of this baseline experiment appear in Chapter III.

Five student reversal. If a reversal is included in a baseline experiment, the treatment of interest is abandoned for a period of time and then re-applied. A reversal is achieved if the data move toward the baseline period data and then, once again, reflect the effect of the treatment on the behavior being counted. From this experimental viewpoint, a further test of the grading variable would have been to reverse the scoring scheme used with Group N to partial credit scoring for a period of time and then return to the treatment of interest (no partial credit) for the remainder of the semester. However, this would be a deliberate attempt to cause less learning and would be ethically indefensible in the case of a struggling student. For experimental purposes, five students who ranked around the 75th percentile and whose rank was fairly stable from test to test were selected for a cautious reversal which would test only the power of the treatment. The top ranking students were not selected because many times these students produced near perfect papers and there is little difference in the reported score under either treatment when a student produces a near perfect paper. Because the five students chosen were strong students, it was felt that a short period of PC grading would not be permanently disadvantageous. It was decided also that the final grades of these students would not be affected adversely by their performance during this period. PC grading was applied to three examinations and one homework assignment. Following

the period of PC scoring, all feedback for the rest of the semester was under the NPC grading plan, a return to the treatment of interest.

Applying this reversal to these five students is not the same as applying the less effective treatment to the whole group. Instead, this experiment tested the power of the treatment of interest and possibly could have demonstrated the very great importance of the variable, if the students least likely to be affected by the different treatments were responsive to them. There are a number of reasons why this ideal pattern of data might not emerge. First, because the students involved were high ranking students, they may have had aspirations surpassing the investigator's definition of a satisfactory score. Indeed, it would have been surprising for every student to respond to the reversal. Second, the period of PC grading was quite short. Third, unless the examinations used are very sensitive to the effect they seek to measure, a mild effect may be missed. Also the examinations must be sensitive enough to transmit a different message to good, but imperfect performance. An analysis of this five student reversal appears in Chapter III.

Experimenter bias. In this research design there is no control for the effect of possible unconscious communication of the experimenter's expectations. Because the communication of expectations is not well understood, it can not be stated with certainty that the fact that the investigator

knew that two different treatments were being employed and believed that one would be more effective if either was, was not in some subtle way communicated. The investigator was aware of this difficulty and directed his conscious behavior toward promoting an unbiased experiment.

There are reasons to believe that the role of teacher expectations has been overemphasized. Also, there were features of the instructional method which probably lessened the possibility of subtle communication of experimenter expectations. The entire problem of experimenter bias will be discussed in detail in Chapter IV in association with the outcomes of the experiment.

Footnotes

¹American Institute of Certified Public Accountants, "The College Testing Program," (New York).

²Glen L. Johnson and James A. Gentry, Finney and Miller's Principles of Accounting, 7th ed. (Prentice-Hall, Inc., 1970).

³Robert J. Kibler, Larry L. Barker, and David Miles, Behavioral Objectives and Instruction (McGraw-Hill, Inc., 1970), p. 1.

⁴Gene V. Glass and Julian C. Stanley, Statistical Methods in Education and Psychology (Prentice-Hall, Inc., 1970), p. 496.

⁵Ibid., p. 507.

⁶The Regression Analysis used was programmed originally by Bob Proctor for the Stanford Research and Development Center and adapted at the University of Massachusetts by Lawrence Wightman. The program computes the regression lines for selected variable pairs.

C H A P T E R III

ANALYSIS OF THE DATA

Statement of the hypothesis. The major hypothesis of the study was that a grading plan allowing no partial credit would result in higher student performance than a grading plan allowing partial credit. In order to bias the experiment against the expected effect, the group whose mean performance on the AICPA Orientation Test was lower was the group selected to receive no partial credit grading. Table 1 presents an analysis of the test results with the null hypothesis being that the mean score of Group P is less than or equal to the mean score of Group N. The alternate hypothesis is that the mean score of Group P is greater than the mean score of Group N.

For the post-test and its various parts, the data for the test of the major hypothesis is reported in Tables 3, 4, 5, 6, and 7 with the null hypothesis in each case being that the mean score of Group N is less than or equal to the mean score of Group P. The alternate hypothesis in each case is that the mean score of Group N is greater than the mean score of Group P.

In Table 8 the frequency of a particular type of defect is being measured. The null hypothesis is that the mean number of such defects made by Group N is greater than or equal to the mean number of such defects made by Group P.

The alternate hypothesis is that the mean number of such defects made by Group N is less than the mean number of such defects made by Group P.

Analysis of the orientation test. As mentioned in Chapter II, the AICPA Orientation Test, Form D was administered at the first laboratory meeting. Table 1 reports on the data analysis of this test.

Table 1

"t"-Test of the Equality of Mean Scores
on the AICPA Orientation Test, Form D

Group	Number of Students ^a	Mean	SD	t	df	Significance Level
P	35	52.0	27.76	1.588	61	.10
N	28	42.0	22.54			

^aOnly those students who were enrolled in the course at the time of the post-test are included in the analysis above. When the aptitude scores of the three students who withdrew from the course are included in the analysis, the mean score on the Orientation Test for Group N is 42.3 with $t = 1.573$. There is no change in the level of significance.

In order that higher performance by the no partial credit group, if attained, could not be attributed to higher aptitude, it was decided that the group with the lower mean score on the AICPA Orientation Test would be the group to receive no partial credit, Group N.

Analysis of examinations 1 through 6. Table 2 presents the results for both sections on the six examinations to which different scoring treatments were applied. The scores given

are percentage marks. Data for Group P are derived from re-scoring their papers according to the NPC plan after the post-test had been given.

Table 2

Mean and Median Scores of Group P and Group N on Examinations 1 through 6 using NPC Grading Rules

Examination	Mean Scores		Median Scores	
	Group P	Group N	Group P	Group N
1	39.4	35.4	40	40
2	66.4	72.6	65	78
3	46.3	56.7	50	60
4	55.2	55.3	55	64
5	53.3	61.8	50	67
6	33.7	39.2	20	40

Note: Group P contained 35 students; Group N contained 28 students. For this comparison the examination papers of both groups were scored according to NPC grading rules.

An examination of Table 2 reveals that on Examination 1 the mean score of Group P was higher than that of Group N. Although the difference between the scores is not statistically significant, the higher mean score of Group P is consistent with the higher mean aptitude score on the AICPA Orientation Test.

Examination 1 was the first feedback for both groups. A study of the mean scores on Examinations 2 through 6 indi-

cates that the performance of Group N consistently exceeds that of Group P -- significantly, except in the case of Examination 4. This result, it should be recalled, is in spite of the higher aptitude of Group P. On Examination 4, where the means are only .01% apart, the median score of Group N is nine points higher than that of Group P. This nine point spread is comparable to the point value of one transaction of eleven on this particular examination.

For analytical purposes the post-test was scored using both grading plans. In general, Group N, the no partial credit group, performed significantly better than Group P regardless of whether the partial credit grading plan or the no partial credit plan was used. When NPC grading was used in scoring, the results and comparisons are as discussed below.

Analysis under NPC Grading Rules. The results for the post-test scored using NPC rules when each of the four parts is weighted equally, are presented in Table 3. The total weighted point value of the post-test is 100 points.

Table 3

"t"-Test of the Equality of Mean Scores on the
Total Post-Test When Scored Using NPC Grading Rules

Group	Number of Students	Mean	SD	t	df	Significance Level
P	35	56.4	19.35	2.1140	61	.025
N	28	66.2	17.84			

Given the null hypothesis that the means of the two groups' total scores are equal, the test indicates that the hypothesis is rejected. Therefore, Group N, the group that consistently received no partial credit, performed significantly better on the post-test ($p = .025$).

Part I of the post-test was similar in form to previous examinations. In this part there were seven transactions to analyze. Under the no partial credit plan a point was awarded for each transaction answered correctly in its entirety. Table 4 reports on the analysis of the results under NPC grading rules.

Table 4

"t"-Test of the Equality of Mean Scores on Post-Test,
Part I, Using NPC Grading Rules

Group	Number of Students	Mean	SD	t	df	Significance Level
P	35	3.7	1.75	2.0042	61	.025
N	28	4.5	1.48			

The hypothesis that the means are equal can be rejected at the .025 level of significance.

Parts II and III of the post-test asked for previously studied concepts and principles in a new format. Part IV of the post-test was similar in form to the two examinations given just prior to the post-test. The point value of these three parts was 16, 10, and 25 points, respectively. Table 5 presents the analysis of the results of these three parts.

Table 5

"t"-Test of the Equality of Mean Scores on Post-Test,
Parts II, III, and IV, Using NPC Grading Rules

Part	Group	Number of Students	Mean	SD	t	df	Significance Level
II	P	35	6.0	4.03	2.3025	61	.025
	N	28	8.2	3.58			
III	P	35	7.2	2.26	2.6506	61	.01
	N	28	8.6	1.37			
IV	P	35	14.9	7.52	.6942	61	N.S.
	N	28	16.3	7.64			

On Parts II and III Group N performed better than Group P and the difference was statistically significant. On Part IV, although Group N scored higher than Group P, there is not a statistically significant difference between the mean scores.

Analysis under PC Grading Rules. When the PC grading plan is used to score Parts I, II, and IV of the post-test (Part III required an objective type response; hence, no partial credit could be assigned to responses on this question.) the same conclusion is reached, as illustrated in Table 6. Again, each part is weighted equally with the total weighted point value being 75 points.

Table 6

"t"-Test of the Equality of Mean Scores on Post-Test,
Using PC Grading Rules

Group	Number of Students	Mean	SD	t	df	Significance Level
P	35	56.5	9.75	1.6999	61	.05
N	28	60.5	8.54			

Again the null hypothesis can be rejected, this time at the .05 level of significance. Although the significance level drops when partial credit scoring is used, the change does not justify an acceptance of the null hypothesis. It is probably contributory to the inferiority of partial credit grading that one of its tendencies is to make good and poor performances appear more alike.

When Parts I, II, and IV are scored according to PC grading rules, the point values of these parts are 36, 48, and 69 points, respectively. Table 7 presents the analysis of the results of these three parts.

Table 7

"t"-Test of the Equality of Mean Scores on Post-Test, Parts I, II, and IV Using PC Grading Rules

Part	Group	Number of Students	Mean	SD	t	df	Significance Level
I	P	35	26.9	5.58	2.2900	61	.025
	N	28	30.1	4.47			
II	P	35	32.3	7.25	1.6858	60	.05
	N	28	35.3	6.58			
IV	P	35	56.3	13.48	.2945	60	N.S.
	N	28	57.2	9.99			

For Parts I and II the performance of Group N exceeded that of Group P and the difference was statistically significant. As under NPC grading on Part IV the mean score of Group N exceeded that of Group P without reaching a significant level.

Item analysis. An individual item analysis of student performance on the post-test was made in order to identify those specific items on which one group's performance exceeded the other group's. These results appear in Appendices E-1 and E-2.

When the post-test was scored using NPC grading rules, Group N's performance exceeded Group P's on 34 of 44 items (77% of the items): five in Part I, 13 in Part II, nine in Part III, and seven in Part IV. Of these 34 items the difference in performance was statistically significant on 13 at the .05 level or better. Of the ten items on which the performance of Group P exceeded that of Group N, there was only one item on which there was a difference at the .05 level.

When the post-test was scored using PC grading rules, Group N's performance exceeded Group P's on 28 of 34 items (82% of the items): six in Part I, 15 in Part II, and seven in Part IV. (As mentioned earlier Part III could not be graded using partial credit.) On seven of these 28 items the difference was statistically significant at the .05 level or better. Of the six items on which the performance of Group P exceeded that of Group N, none was statistically significant.

Regression analysis. The results of the regression analysis appear in Figures 4, 5, 6, and 7. Each line is a regression showing the average score obtained under a treatment at the observed aptitude level, when each of the four parts

Figure 4

Graph of Regression Lines for Part I Scores of the Post-Test for Each Treatment Group against the Orientation Test Percentiles as an Aptitude Measure

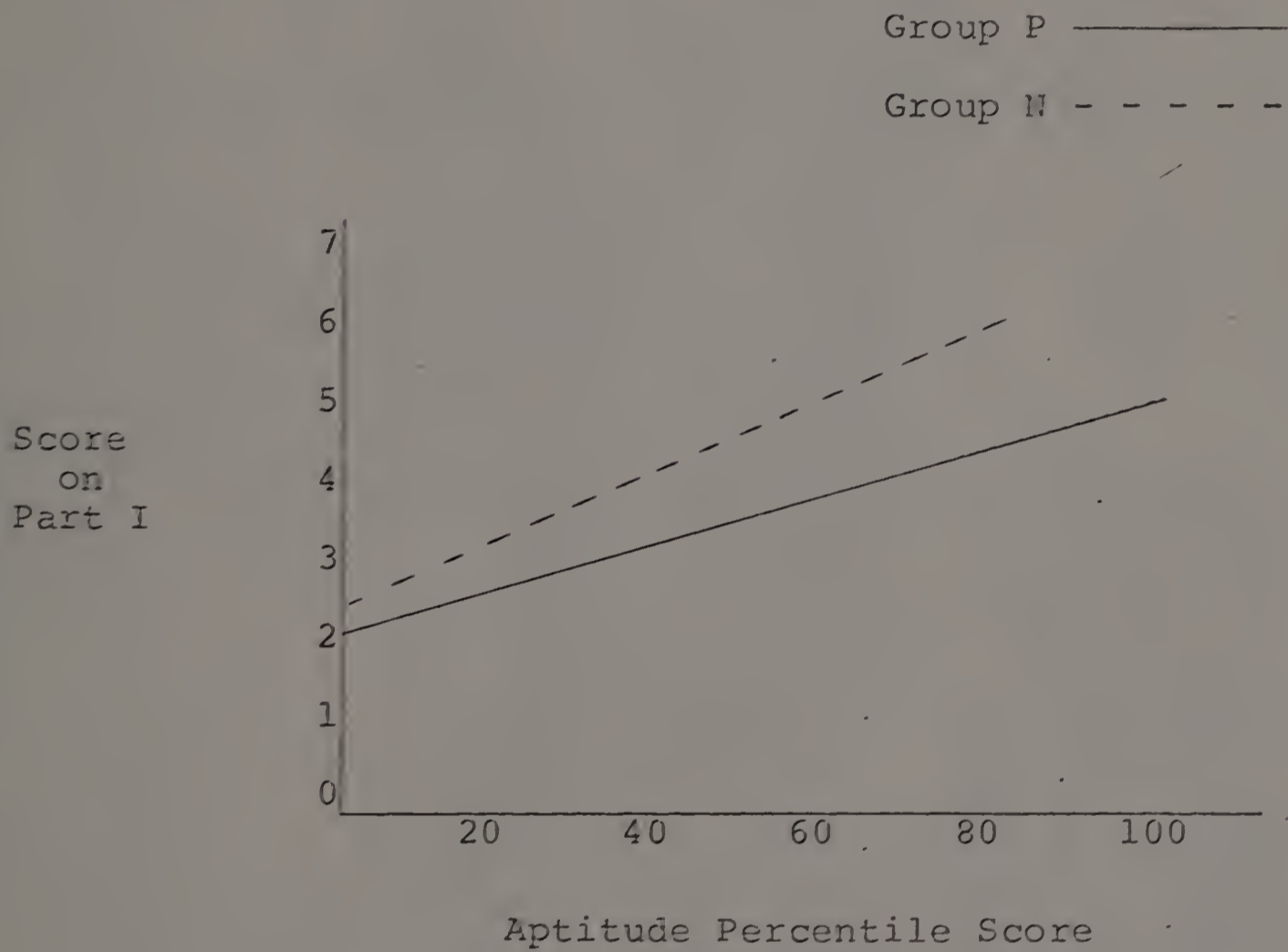


Figure 5

Graph of Regression Lines for Part II Scores of the Post-Test for Each Treatment Group against the Orientation Test Percentiles as an Aptitude Measure

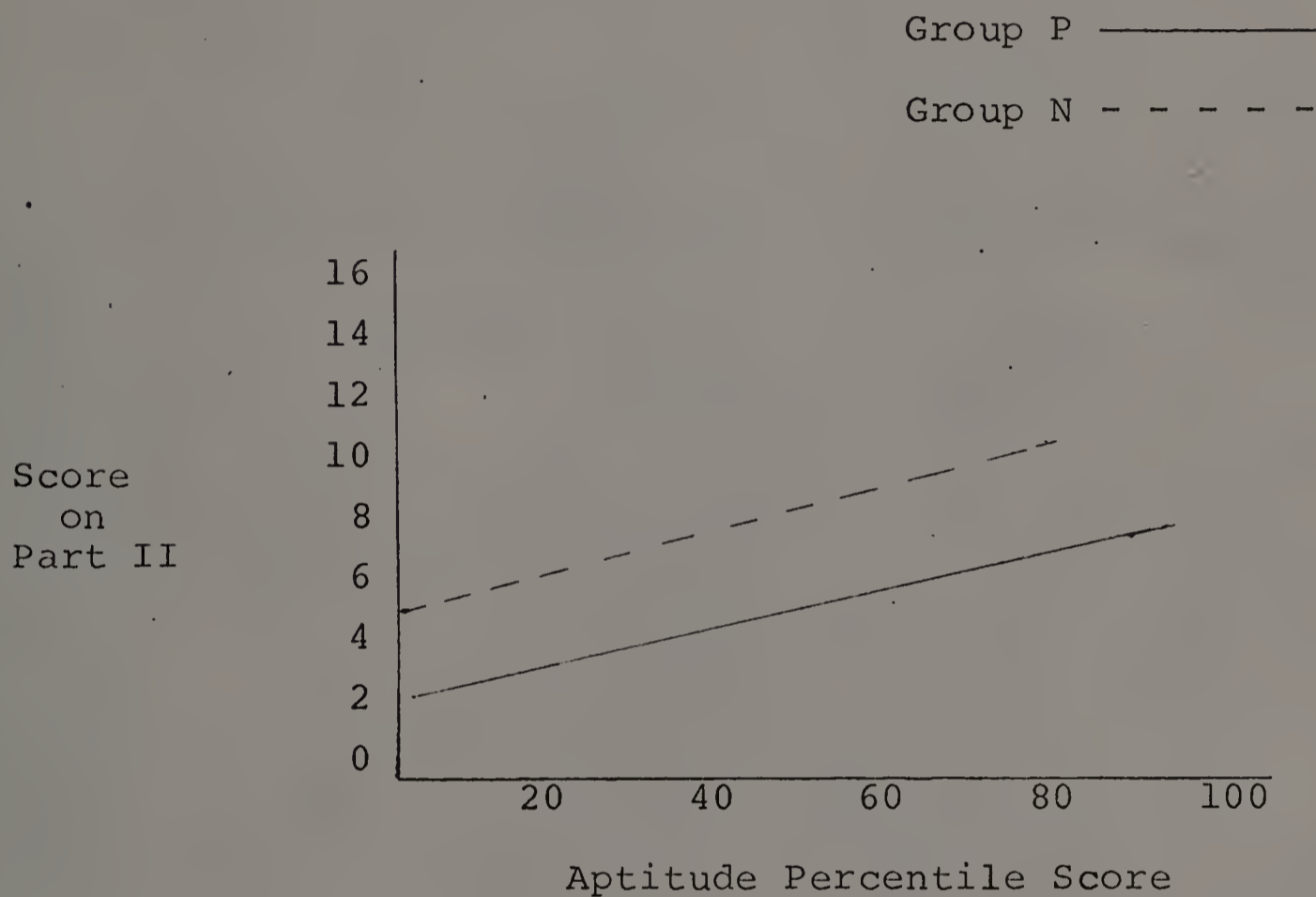


Figure 6

Graph of Regression Lines for Part III Scores of the Post-Test for Each Treatment Group against the Orientation Test Percentiles as an Aptitude Measure

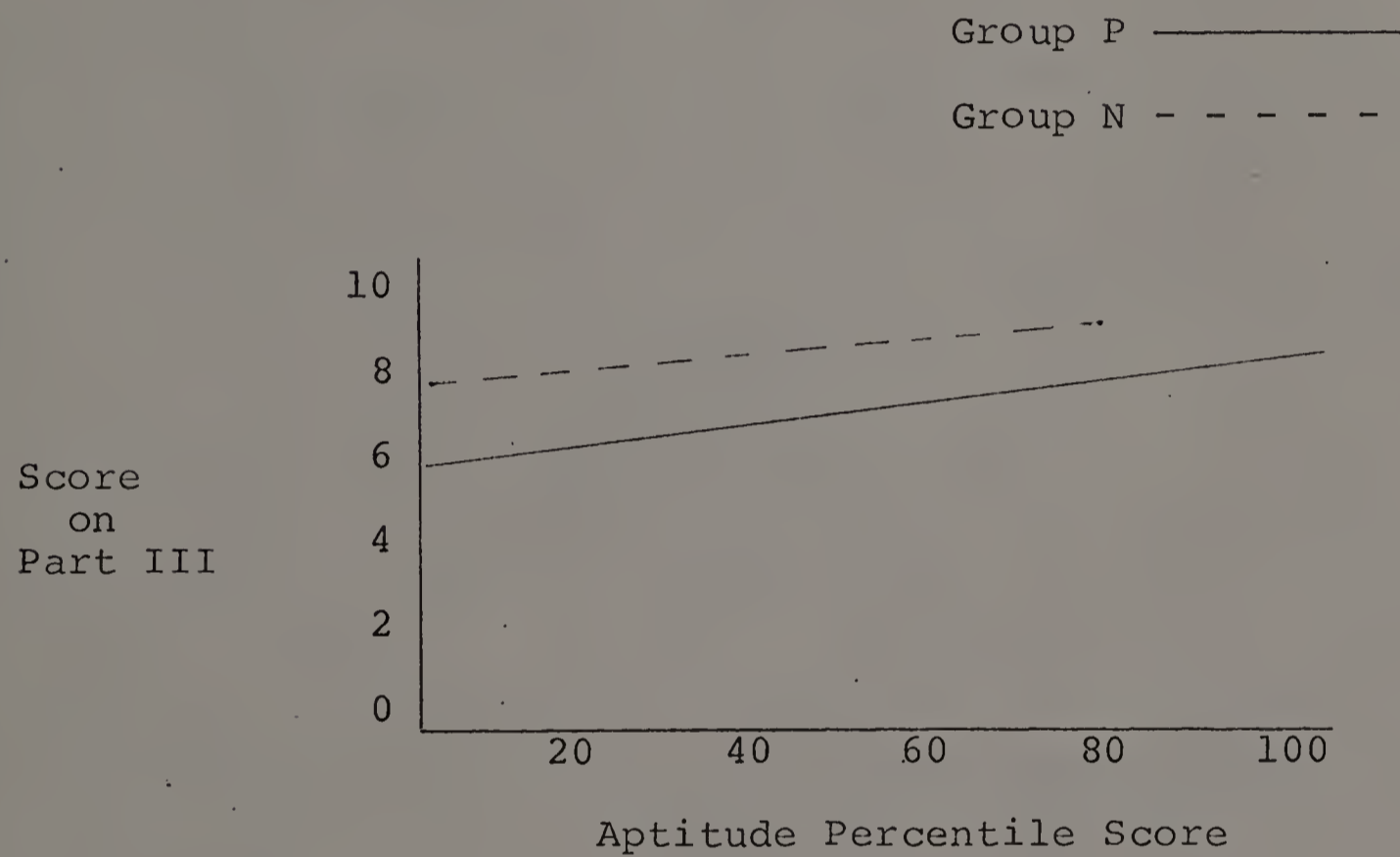
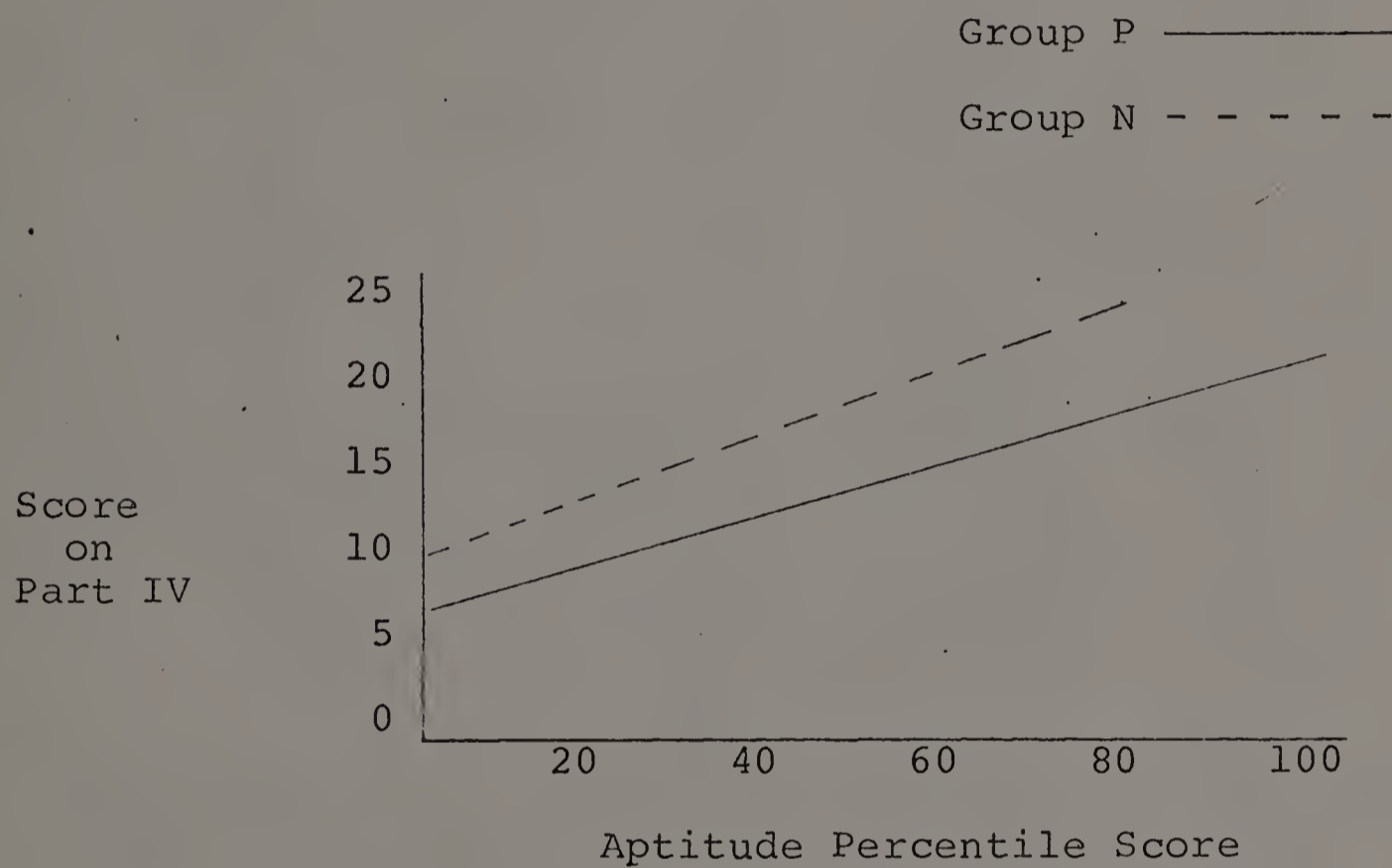


Figure 7

Graph of Regression Lines for Part IV Scores of the Post-Test for Each Treatment Group against the Orientation Test Percentiles as an Aptitude Measure



of the post-test is regressed on the aptitude scores as determined by the orientation test. (The regression lines extend only over the range of aptitude of students in the group.) For each part of the post-test the regression line of Group N is above that of Group P.

Incidentally, the program to compute the regression lines provides an F statistic, bearing on the parallelism of the lines. This number was very small (.09 to .79). The ratio would have to be far higher (4.00) to reject the hypothesis that the lines are parallel. The analysis does not indicate that different treatments affected different aptitudes in a significantly different way.

A closer study of the regression lines reveals some interesting comparisons. Students in Group N having aptitude scores at the fiftieth percentile would score on the average as well as students in Group P having aptitude scores at the nintieth percentile on Parts I, II, and III. On Part IV Group N students with fiftieth percentile aptitude scores would score on the average as well as Group P students with seventieth percentile aptitude scores.

The regression lines given by the analysis imply that when aptitudes are equal, under no partial credit, there will be higher performance. This is generally true, but there will be exceptions. This is illustrated by the following detailed analysis.

Having combined the two groups, all students were ranked according to their aptitude scores. The post-test scores for the students in the combined group were ranked also. These rankings appear in Appendix F. The post-test ranks of only six students in Group N were below their aptitude ranks. Nearly every Group P student ranking in the top half of aptitude performed below his or her potential as measured by the orientation test. With the exception of a majority of students in the top 25%, nearly all the students from Group N performed at or above their potentials as measured by the orientation test.

Impossible answers. The following illustration, Figure 8, (similar to the example given in Figure 1 in Chapter I) is a portion of Part II of the post-test.

In a study Frank A. Singer analyzed a similar question in the following manner.

To the right of the double line is the fundamental accounting equation which is a definition of total owner's equity. The relationship is:

$$(\text{total assets} - \text{total liabilities}) = \text{total owner's equity}$$

The items on the left are the elements of an equation which is a definition of net income. The relationship is:

$$(\text{total revenue} - \text{total expense}) = \text{net income}$$

These concepts and principles occur early in any elementary textbook. Virtually the entire course is built upon these relationships. They are clearly prerequisites to the learning of topics which occur no later than the third week of the course. No knowledge of accounting is necessary to recognize that the equation can never be affected in certain ways, e.g. changed on one side of the equal sign and not changed on the other, as illustrated on the right-hand side of (Case) 1. (Total owner's equity should be minus.)¹

Figure 8

An Illustration of Impossible Answers

Required: Indicate the actual effect (both before and after closing) of the following independent errors on each of the accounting elements described in the column headings below.

Use the following code: + overstated - understated 0 no effect

Question Stem	Error	Net Income	Total Revenue	Total Expenses	Total Assets	Total Liabilities	Total Owners' Equity
Example Response	A failure to record an investment by an owner.	0	0	0	-	0	-
Test Responses	Case 1 Failure to record a sale of a service	-	-	0	-	0	X 0
	Case 2 Revenue is credited when cash is collected from a credit customer.	+	+	0	+	0	+
	Case 3 Failure to adjust prepaid expense so it remains overstated.	+	X -	-	X -	X -	X -
	Case 4 No adjusting entry was made to record accrued salary payable.	+	X +	-	X +	-	X 0

Note: An X indicates an incorrect response.

Singer labels an error of this type as an "impossible answer." When a student produces an impossible answer, he is denying understanding of either a concept or a principle or both.² Singer also identifies impossible answers based on limited assumptions about the student's understanding of the cases. One of the assumptions is that the student noted that a single amount was stated or implied. Given this assumption, when a response by the student has a balance sheet change and an income statement change, one cell on each side of the double line must be zero. The student's response to the income effect in Case 3 is an illustration of this type of error. The debit which would overstate assets could only be offset with a credit to either revenue or expense but not to both. To believe that both the debit and credit errors affect revenue and expense is to believe these changes can occur when neither assets nor liabilities are affected. The effect on either revenue or expense must be zero since the student's response stated that there was a balance sheet change.

A search was made for impossible answers in Part II of the test papers of both groups. Table 8 reports in the occurrence of impossible answers in Part II.

Table 8

"t"-Test of the Equality of the Mean Number of
"Impossible Answers" in Part II of the Post-Test

Group	Number of Students	Mean	SD	t	df	Significance Level
P	35	7.7	3.61	2.5536	61	.01
N	28	5.5	3.01			

Group N had fewer impossible answers and the difference was significant.

The most important question is how many students learned usefully well. Since a 100% correct response is the implied standard for correctly learned concepts, only random error need be allowed for in deciding that the student does not know the fundamentals.³ Making a generous allowance of regarding two impossible answers in 16 as random (an allowance for a student's misreadings of his own responses), there is a striking difference in the number of students who met the criterion. In Group P only three of the 35 students (9% of the group) made two or fewer impossible answers. In Group N, six of the 28 students (21% of the group) made two or fewer impossible answers. Although neither group's performance could be called adequate, Group N's ratio of students who met the criterion is almost two and a half times larger than Group P's.

It is of interest to note that two of the three students in Group P who met the criterion had aptitude percentile

scores at least fifteen points higher than the highest aptitude score of any student in Group N. Allowing four, or even six, impossible answers as random, the proportions remain approximately the same. Only 11% of Group P made four or fewer impossible answers as compared to 35% of Group N. For a too-generous criterion of six or fewer impossible answers, 35% of Group P met the criterion whereas 67% of Group N did.

Part III of the post-test can be analyzed for another type of impossible answer. Illustrated in Figure 9 are the instructions given and three items from Part III of the post-test.

On item A, even if the titles of the accounts are ignored, neither account could be an asset or an expense because each has a credit balance. As it turns out, only the correct response to "A", answer 4, and answer 6 lack this property. (1 is wrong because neither could be an asset; 2 is wrong because an expense account can not have a credit balance; 3 and 5 can be similarly rejected.) Any time a student gives a response of 1, 2, 3, or 5 for an item with a correct response of 4 or 6, the answer given is an impossible answer.

In case it is not obvious, there are always four of the six cases which, ignoring titles, can be unconditionally ruled out in a way similar to the example above as being impossible answers. When the correct response to an item is 1

Figure 9

A second Illustration of Impossible Answers

Question Stem	<p>All adjustments are accomplished by one of the following six pairs of changes.</p> <ol style="list-style-type: none"> 1. an asset is increased and a revenue (or income) account is increased. 2. a liability is increased and an expense is increased. 3. an asset is decreased and expense is increased. 4. a liability is decreased and a revenue (or income) account is increased. 5. an expense is decreased and an asset is increased. 6. a revenue (or income) account is decreased and a liability is increased.
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Answer Sheet	<p>Here are several examples of completed adjustments. Indicate the combination of changes, from the above list, of which it is an example.</p> <p>CIRCLE the appropriate number.</p> <p>-----</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">A.</td> <td style="width: 20%; text-align: center;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;"><u>Unearned Rent</u></td> <td style="text-align: center;"><u>Rent Earned</u></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> </tr> <tr> <td style="text-align: center;">(a) 300 1300</td> <td style="text-align: center;"> (a) 300</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">4</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;">6</td> </tr> </table> </td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> </tr> <tr> <td colspan="5">-----</td> </tr> <tr> <td>B.</td> <td style="text-align: center;"> <table style="width: 100%; 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Note: In each case, the responses that are marked X are impossible answers.

(as it is in case B) or the correct response is 2, the impossible cases would be 3, 4, 5, and 6. When the correct response to an item is 5 (as it is in case D) or the correct response is 3, the impossible cases would be 1, 2, 4, and 6.

An analysis of the occurrence of impossible answers in Part III reveals that the median frequency of impossible answers in Group P was two whereas in Group N the median frequency of impossible answers was one. Even more significant, it seems, is that 26 students in Group N (92% of the group) made two or fewer impossible answers while 25 students in Group P (only 68% of the group) met this criterion.

Analysis of the baseline design. In Chapter II this experiment was compared to a baseline experiment and the similarities in design were noted. The application of no partial credit to Group N demonstrated a prompt and consistent advantage up to and including the post-test. Thereafter the NPC treatment was applied to the other group (Group P), and eventually there were two observations of equal performance. Looking at the data from the viewpoint of a baseline design experiment, the treatment of interest has been shown to be effective. Figures 10 and 11 present a series of graphic analyses of the performance of the two groups throughout the experimental period.

The graphic analyses indicate that the effect on performance, when no partial credit scoring was utilized at the beginning of the semester, was immediate. When the plan was

Figure 10
Median Scores of Group P and Group N on the Examinations

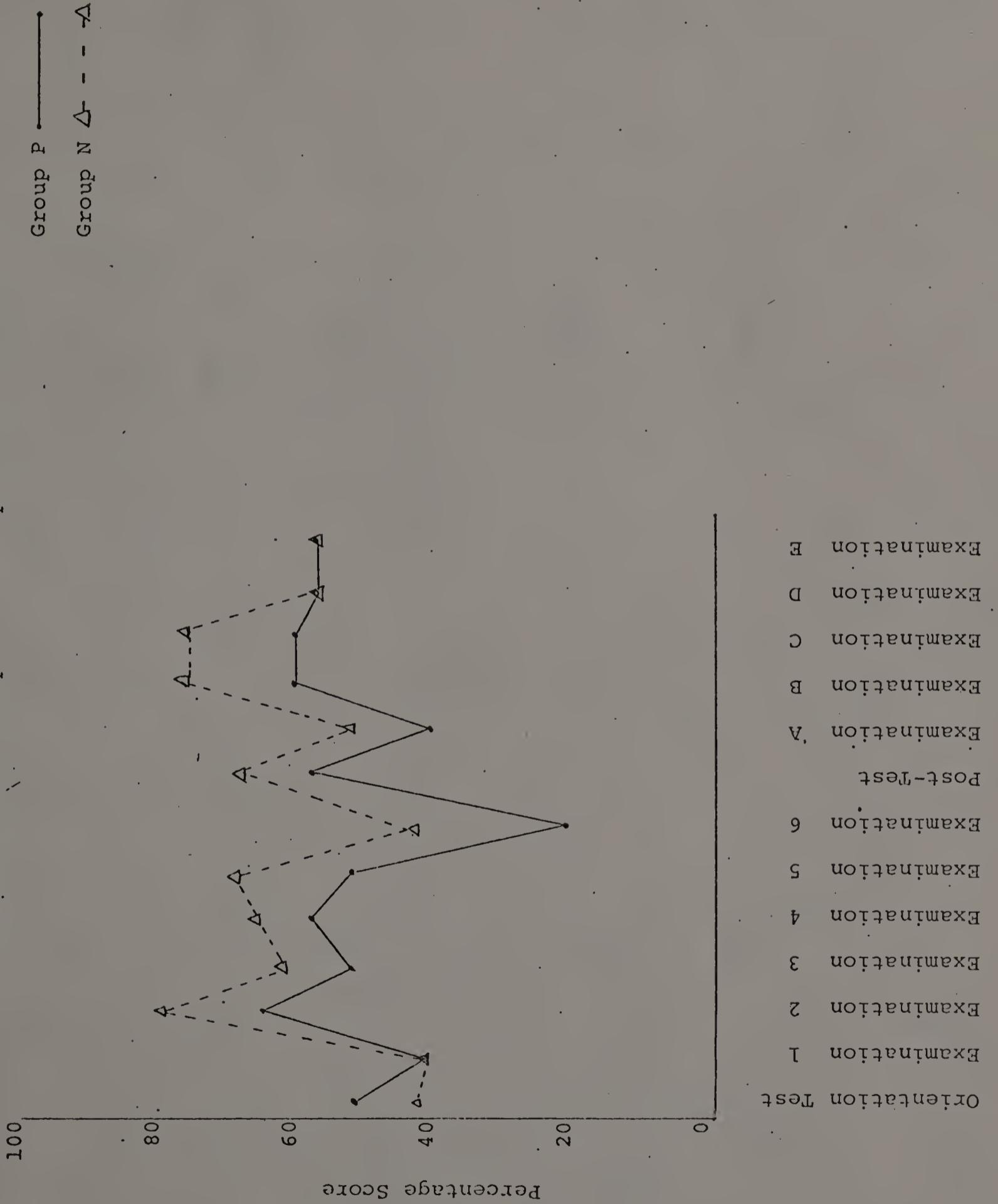
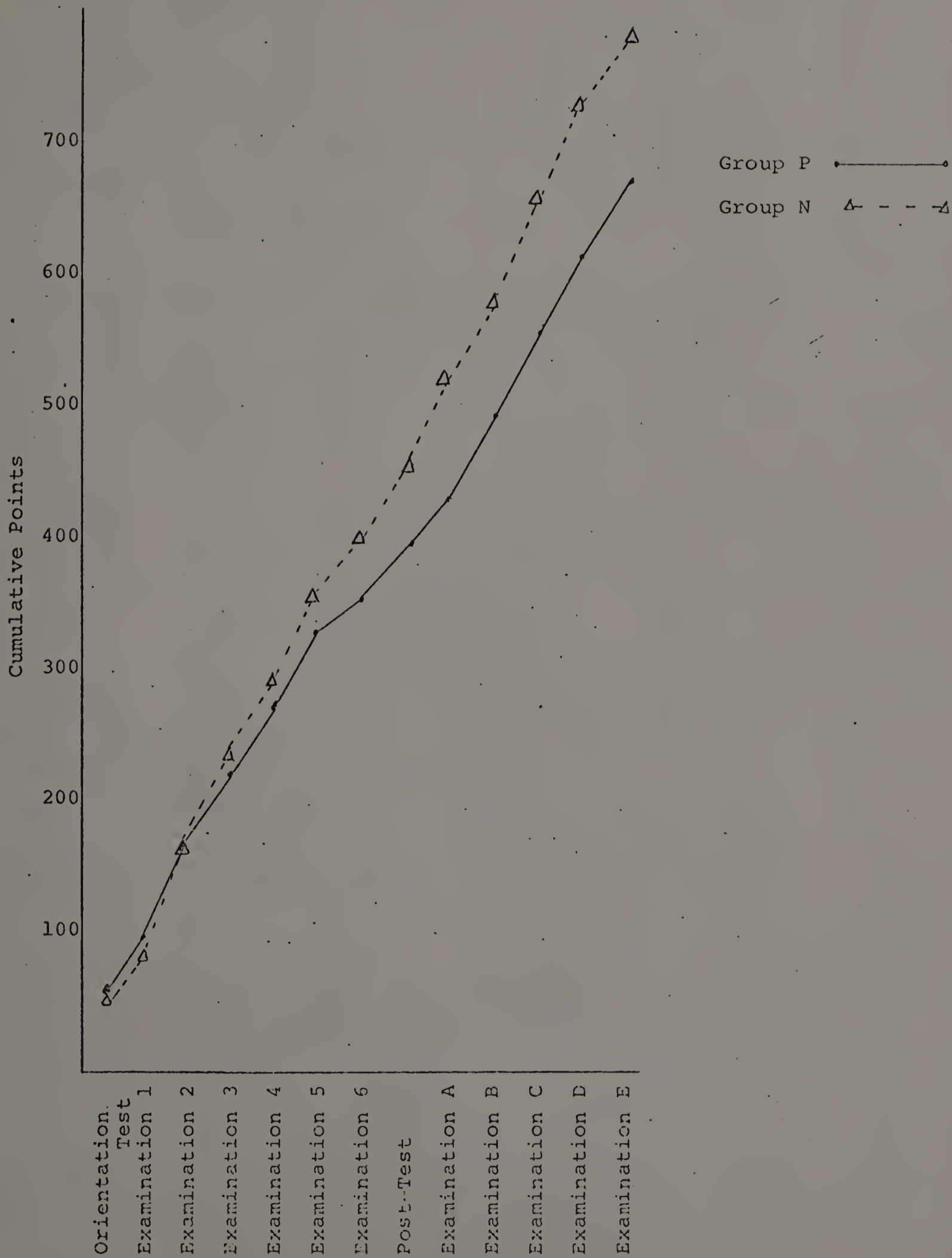


Figure 11

Cumulative Median Scores of Group P and Group N on the Examinations



employed on students who previously had been scored under partial credit, the performance of Group P did not equal that of Group N until the fourth examination after the post-test. The eventual equality of performance was not necessary to a demonstration of the effectiveness of NPC grading of Group P. Rather, all that was needed was a movement of the data toward equality.

Because in a comparison of means it is difficult to see whether the treatment has begun to have an impact, it was felt that a more sensitive indicator was needed. It was decided to compare the number of Group P students who scored at or above the median score of Group N on the post-test and the examinations following. Table 9 presents this information.

Table 9

Number of Group P Students Who Scored At
or Above the Median of Group N

<u>Examination</u>	<u>Number of Students</u>
Post-test	11*
A	14
B	14
C	12
D	18
E	18

*This is the number of students whose score was equal to or superior to the median score of Group N for the total post-test. The overall relationship is equal to or better than any of the four parts.

On examinations A through E the number of Group P students reaching the median score of Group N was higher than at the time of the post-test. The fact that full equality is not achieved immediately is probably due to the fact that there are principles and concepts that must be mastered before new learning can take place. When a new treatment is applied, all the students are not affected in the same manner. The mean score measures a change in a subset of each group, not a change in every member. Also, when a comparison of the rankings of the combined group is made, a majority of the Group P students in the third and fourth quarters performed closer to their aptitude rankings on the final than on the post-test. However, a majority of Group P students in the lowest quarter performed at or below their aptitude rankings on both the post-test and the final examination. It might be concluded that the application of NPC grading affected most, but not all, Group P students.

It would seem that changing the contingencies had the greater effect on the upper half of Group P. The change from partial to no partial credit caused most students to respond by producing more correct answers. One might have anticipated that the majority of those responding would have come from the half of the group with higher aptitude and corresponding higher performance up to the time of the post-test as these students were better able to change. Students in the lower range of aptitude usually would have found it

necessary to struggle to attain the necessary principles and concepts even under NPC grading. The period of PC grading probably caused them not to study as much as was necessary and thereby was very damaging to their chances for success.

Analysis of the five student reversal. In a successful reversal the performance of students would decrease after the abandonment of NPC grading and improve after the re-application of this treatment. In general, this pattern did not emerge. As was mentioned in Chapter II only this very limited reversal was attempted because of ethical considerations. Even before the experiment began there was recognition that the five students' performance might not resemble the expected pattern. The factors which may have caused this pattern not to emerge should be reviewed. The first two, discussed in Chapter II were anticipated; the third was not anticipated.

First were the students themselves. When the examinations were being planned, the individual aspirations of the students could not have been considered. Because four of the five students scored consistently above average both before and after the post-test, it is quite possible that they may have had aspirations independent of the investigator's definition of a satisfactory grade.

Second, the short period of time during which the work of these students was scored under the PC grading plan may have contributed to the non-emergence of the expected pat-

tern. Only three examinations and one homework assignment were scored in this fashion. It is possible that, even with the best of examinations, four opportunities for feedback would not have been enough.

Third, the examinations which were given after the post-test, from an experimental point of view, probably were not sensitive enough to demonstrate the difference between PC and NPC grading, especially for high performing students. The items for these examinations were not chosen, as they might have been, so as to make a perfect score unlikely. This lack of sensitivity is confirmed by the fact that one of the five students received the highest possible score on all his papers during this period and another student had the highest or second highest possible mark on his papers. There is no difference in the message being sent under either grading plan when students produce perfect or near perfect papers. It would seem that, during the planning phase of the experiment, the difficulty of the examinations given during this reversal period should have been controlled more carefully.

On the examinations given after the post-test, the emphasis was on testing new material. In contrast to the examinations given before the post-test, the items on these examinations did not attempt to re-examine previously tested topics. On the examinations before the post-test the emphasis was on transactions, and a student who corrected his earlier mistakes often was rewarded by success on a similar

item on a subsequent test. On the examinations after the post-test this was not the case. This lack of retesting makes it most difficult to determine if the students had responded to the errors they had made on earlier examinations. Therefore, in retrospect, it would seem that the design of each examination should have included a section reviewing previously presented subjects and that the difficulty factor should have been considered more.

Had the data for the five students responded to PC grading by falling toward the average, the experiment would have indicated the great power of the grading variable. Before the execution of the reversal, the feeling was that these high-ranking students might be lured into overconfidence. The fact that this pattern did not emerge may have been due to the shortcomings in design previously described. Better execution would have eliminated, at least, so many perfect scores and might possibly have produced the reversal pattern in the data. On the other hand, the reversal might have been no more successful with an ideal execution, indicating that the treatment is less powerful at the 75th percentile and above. Regardless, the non-emergence of the expected pattern with these five students does not diminish the importance of the grading variable as it affected the entire group of students in the main part of the experiment.

Log. During the course of the semester a log was kept of those students who sought individual aid during the in-

investigator's office hours. A tally of the number of students making individual visits after each examination for each group appears in the first and third columns of Table 10. The second and fourth columns are a cumulative total of the number of students who have made at least one visit seeking aid.

Table 10

Record of Students Seeking Help During the Semester

Examination	Group P		Group N	
	No. of students visiting after each examination	First time visits	No. of students visiting after each examination	First time visits
1	2	2	5	5
2	3	4	4	7
3	4	5	6	11
4	3	7	5	14
5	5	10	7	17
6	3	12	8	21
PT	7	15	5	22
A	8	19	3	22
B	5	21	4	23
C	7	24	4	23
D	5	26	3	23
E	4	27	4	23

In reviewing this record, it can be seen that in Group P 12 students or 34% of the total group sought aid at least once before the administration of the post-test. In Group N, 21 students or 75% of the group sought aid at least once. By the end of the semester 27 students or 77% of Group P sought aid at least once and 23 or 82% of Group N sought help

at least once. At the end of the semester after both groups had been scored under the NPC grading plan the percentages of students seeking help were almost equal. However, at the time of the post-test, more than twice the percentage of students from Group N (no partial credit) had sought aid than the percentage of students from Group P. The 23 students in Group P who did not seek individual aid prior to the post-test show no obvious tendency to come from a particular aptitude range. Of the eight students in Group P who did not seek aid at least once during the semester all but one ranked in the lower half of their group on the aptitude test.

Of the seven students in Group N who did not seek individual aid prior to the post-test, all but one ranked in the lower half of their group on the aptitude test. The five students who did not seek help at least once during the semester all ranked in the lower half of their group's aptitude rankings.

It might be inferred that an advantage of a no partial credit plan is the recognition by the student of a need for the instructor's assistance.

Footnotes

¹Frank A. Singer, Self-Instructional Materials for Topics in Elementary Accounting -- A Means to the Demonstration of Pay-offs from Individualizing Time-to-Complete (U.S. Department of Health, Education, and Welfare, Office of Education, Bureau of Research, September, 1972), p. 34. (ED 082 291).

²Ibid.

³Ibid.

C H A P T E R I V

CONCLUSIONS, IMPLICATIONS, AND FURTHER RESEARCH

Conclusions

The data presented in Chapter III support the conclusion that in this experiment the grading plan which allowed no partial credit resulted in higher student performance than the grading plan which allowed partial credit. Comparison of median and mean scores, the regression analysis, and the frequency count of two types of "impossible answers" all show a regular and impressive advantage of Group N over Group P. Moreover, this advantage reverses the relative standings of the groups on an aptitude measure and the first (pre-treatment) performance test. The relative improvement in performance of Group P, and most of its individual members, under no partial credit grading during the last part of the term offers further evidence that the better performance of Group N during the initial experimental period was due to the superiority of the grading feedback given them. The five student reversal was the only possible confirmation which contributed no evidence supporting the advantage of no partial credit grading, and the execution of that part of the experiment, unfortunately short of ideal, makes it impossible to decide the issue toward which it was directed. The treatment may or may not be powerful enough to influence above-average students in a few weeks.

The fact that the students scored under no partial credit performed better than those scored under partial credit was probably due, in part, to the fact that more students scored under no partial credit assessed the numbers given them on their examinations as feedback as indicative of unsatisfactory performance. It was mentioned previously that letter grades were not assigned to the numerical scores the students received on their papers, and it should be reiterated that what is satisfactory to one student often is not satisfactory to another. Students' individual goals undoubtedly range from the student who wants only to pass the course, through the student who wants a "good grade" in the course, to the student who desires concept mastery and is satisfied with no less.

However, it probably can be assumed that certain grades will be perceived as being unsatisfactory by almost every student. For instance, on examination 3, 47% of Group N students and 10% of Group P students had scores reported to them of 50% or lower. Although a passing grade had not been defined, it is unlikely that many students scoring less than 50% perceived their performance as satisfactory. Whether or not these students perceived their marks as unsatisfactory, they became aware that there was a great deal left to learn and that a given amount of study could produce a significant gain in results. Such perceptions, as those formed by the Group N students, can lead to efforts to learn more because the opportunity to obtain a better grade is evident. Even if a student

corrects only one type of mistake which he has made on a previous examination, under no partial credit grading the credit gain can be substantial. Because many students have limited time resources, it is likely that they will allocate their time to the course where it is evident that gains can be made readily. Also, when students realize that they will not be given partial credit, many of them will pay more careful attention when there are defects.

That more Group N students sought help during office hours is an obvious example of their greater concern. When students came to the office, they usually asked specific questions about previous examinations; they did not ask questions about new material and their visits could best be characterized as having been prompted by test results. Because PC scores were higher for the same performance, it is likely that many more Group P students perceived their marks as satisfactory, and therefore did not make the same efforts to improve. Because many of these students had not learned sufficiently well and needed to improve in order to succeed with later material, PC scoring was detrimental to their chances for future success.

One might argue that the lower reported scores when NPC grading rules were used may have been the primary cause of Group N's superior performance. It is reasonable at this point to question whether a grading system which allowed partial credit but required a high mark to pass would be as

effective as the NPC system. This possibility is not dismissed. The question of alternative hypotheses for the results obtained in the study is discussed in the Analysis and Further Research section of this chapter.

Presumably, no teacher would deliberately use a grading plan which causes students to learn less. Based on the analysis of the data presented earlier, it is obvious that some teachers have been using grading methods which have not been particularly effective because they allowed some credit for incorrect answers. The study just completed has shown dramatically that students can do better than PC grading prompts them to do and that the simple decision to use NPC rules can make an impressive favorable difference. If the data generated by the study can be taken at face value, a strong case has been made for the hypothesis that the no partial credit grading plan will lead to higher performance than the partial credit grading plan. Before accepting this assessment, an answer is necessary to two possible criticisms.

Possible Criticisms

Attrition. A preliminary reaction to the fact that all the withdrawals were from Group N might be to question the significance of the results of testing the means. The question might be raised of whether the three who withdrew, had they remained and performed very poorly, would have reduced the mean performance of Group N significantly. Regardless,

the results of the regression analyses clearly show that, at all levels of aptitude, students graded under the NPC plan tend to perform better than students graded under the PC plan. Atypical scores from three students could not have altered this finding significantly. A closer look at the data reveals that the mean score of these three students on the AICPA Orientation Test was 44.3. The mean score of those who remained in the same group was 42.0. Two of the students withdrew after the second examination and saw only the results of their first examination. The third student withdrew after the third examination, but never came to any of the sessions when the examinations were reviewed. The performance of the three students on the examinations up to the time of withdrawal could best be described as average. Because two of the students withdrew from school completely and the third did not complete any of his courses in the semester, there is no strong reason to believe that the treatment caused the students to withdraw.

However, if these students had belonged to the bottom of the performance distribution (only one of the three actually did up to the time of withdrawal), which is the position they would have to have had to change the mean results, then the question arises of whether or not it would have been valuable to keep them as participants in the course. If these students would have eventually failed the course because they had not mastered the principles and concepts

necessary to succeed on the examinations, then it is difficult to see the value of their continuing the course fruitlessly. Of course, if they would have mastered the necessary principles and concepts for later success and the treatment caused them to leave, this is unfortunate. However, if it is true that the use of PC grading would have kept in three more students who would have mastered the course, then it should be remembered that this result is being purchased at the sacrifice of the many students who performed better under NPC grading. Regardless, all evidence points to the conclusion that the students withdrew for reasons other than the treatment.

Experimenter bias. A more serious question is whether or not experimenter bias is a likely explanation of the results. It should be restated that the possibility of the unconscious communication of different expectations to the two groups was uncontrolled. A zero weight can not be insisted upon for this factor in the explanation of the results. (However, it is not ruled out.) The question of how differing expectations are communicated has not been answered. No responsible person would argue that this occurrence is magical; rather, it is a very subtle communication on the part of the experimenter or his agent to the subjects.

Good and Brophy, two researchers who have studied classroom interaction extensively, have found that teachers treat students of different types in different ways and see indi-

vidual students as belonging to groups possessing different common characteristics.¹ Rosenthal and Jacobson, in their study, concluded that teacher expectations affected students' achievement.² Their results occurred in three of the six grades they studied (the earliest grades, it should be noted). Two of these three cases were statistically significant. Although the statistically significant differences were large enough that they made the data for all grades likewise significant, it seems to some observers that Rosenthal and Jacobson have exaggerated the significance of their data. Half of the cases were not affected, and, therefore, one can assume that the effect is not automatic in every case. Rosenthal discusses the generality of the experimenter effects as follows:

How pervasive are the unintended effects of the experimenter on the results of his research, and how much ought we to worry about them in our day-to-day research activities? The answer to the first part of this question seems simple. We don't know. No one knows. It seems reasonable to suppose that there may be experimenters doing experiments the results of which are unaffected by the experimenters themselves. Unfortunately, we don't know who they are or which of their experiments, if not all, are immune to their own unintended effect. This lack of specificity in our knowledge suggests the answer to the second part of our question. It seems more prudent to worry than not to worry about experimenter effects in our day-to-day research.³

As mentioned before, when a communication of expectations occurs, exactly how it happens is not settled. Good and Brophy in an attempt to study this phenomenon have set

up a model which they believe describes the underlying processes so that "expectation effects, if they exist, may be seen as the outcome of observable sequences of behavior."⁴

Their research begins with the following assumptions.

a) The teacher forms differential expectations for student performance; b) the teacher then treats the children differently in accordance with his differential expectations for them; c) different children will respond in different ways to the teacher because they are being treated differently by him; d) in responding to the teacher, each child will tend to exhibit behavior which complements and reinforces the teacher's particular expectations for him; e) as a result, the general academic performance of some children will be enhanced while that of others will be depressed, with change being in the direction of teacher expectations; f) these effects will show up in the achievement tests given at the end of the year, providing support⁵ for the "self-fulfilling prophecy" notion.

It is reasonable to accept Good and Brophy's assumptions as valid, because they are based on their research and on other research showing findings of differential expectations having an effect. A further assumption which it seems logical to make is that the ability of the students to distinguish between their treatment and the treatments given other students may well be a contributory factor to the differing outcomes. (The Rosenthal experiments compared students in the same class.) In the experiment reported in the preceding chapters there are a number of features, some deliberately adopted, which reduce the opportunity for, or the probability of, the occurrence of the behaviors which Good and Brophy believe

lead to the difference in outcomes.

First, examinations were not compared during the initial phase of the experiment in order to eliminate the bias shown from early returns. Second, the two groups met separately to reduce the possibility of student awareness of the different grading plans being used. Third, in contrast to the typical cases where experimenter bias has been demonstrated, the experimenter was not present when the subjects made the responses that constituted the data.

Early returns are a factor which has been shown to be a promoter of experimental bias. Because of this factor, in this experiment the examination scores of the two groups were not compared either by the student assistants or the investigator until after the post-test. Although the investigator reviewed a sample set of each examination to determine the correctness of the grading, he made no effort to compare the performance of the two groups until after the administration of the post-test. Usually the names on the sample papers did not call to mind a particular individual.

Since Group N was taught separately from Group P, it would not have been easy for individual students in either group to become aware even if the instructor were behaving differently toward the two groups. There could have been very different behavior toward the two groups. However, this would not have been subtle differences in communication; but rather, deliberate overt behavioral differences on the part

of the experimenter, and the experimenter did not allow these to occur. Seventy-five to 90% of each class was devoted to lecturing on assigned chapter material and to demonstrating solutions to assigned problems. When questions were raised by students, they were answered as fully as possible regardless of the group. The possibility that the experimenter in some way generally encouraged one group while discouraging the other can be discounted because the difference in examination results became apparent at once. For this difference to have been caused by differences in attitude on the part of the experimenter, it would seem that a longer period of time would have been needed to convey attitudinal differences. Also, even if the experimenter's behavior in some way encouraged Group N, the test-score feedback could hardly be interpreted as encouraging or as reflective of a strongly favorable expectation.

In most, if not all, cases in which the question of experimenter bias has been investigated, the experimenter was present or an assistant who had been told or could infer the outcome the experimenter expected was present and interacting with the subjects as they responded (Rosenthal, p. 145, 148, 182).⁶ During this study the investigator was not present when the responses which constitute the data of the experiment were made. The two student assistants alternately monitored the examinations; their sole function was to distribute and collect examination papers. The assistants were instructed

to answer no questions during the examination period. Examinations were administered to the two treatment groups combined so that even if one of the student assistants had some type of expectation it could not have been transmitted to one treatment group only. So far as is known the assistants were unaware that an experiment was being conducted.

An explanation that the experimenter was concerned about the outcome of the experiment and therefore could not help but to communicate his expectations is contradicted by his failure to learn whether individuals belonged to one treatment group or the other.

The opportunity for interaction on a one-to-one basis during class time was limited. While the opportunity for one-to-one interaction did exist during office hours, on seeing the student outside of class the investigator generally was not aware of which treatment group the individual was a member. This lack of awareness indicates that the experimenter was not significantly concerned with the students as members of an experimental group and did not characterize them as "Group N" or "Group P" students. Also, the investigator could not have communicated any expectations he might have had when he was not aware of the treatment group to which the student belonged. The fact that, prior to the post-test, more Group N students made visits than Group P students can be attributed to concern generated by their lower numbered examination scores and their recognition that

they needed to remediate their errors. It should be recalled that students were motivated to come to office hours in order to ask questions about recent examination errors, not about current material.

After the post-test when the same grading rules were applied to both groups, the percentage of Group P students visiting was equal to the percentage of Group N students, further evidence that NPC treatment led to more concern. Had the larger number of visits by Group N students prior to the post-test been the major explanatory factor behind Group N's higher performance up to and including the post-test, their advantage should more nearly have been maintained after the post-test because the percentage of students visiting was equal for the two groups. That Group N's advantage was not maintained is evidence that the difference in performance was not due solely to the frequency of contact. In any case, the office contact frequency is rather clearly a product of the grading treatment.

All of these practices diminish the probability that the steps described in Good and Brophy model took place, with a resultant biasing of the results. It should be noted that there are reasons other than experimenter bias to expect the results obtained.

A challenge. The challenge of this research if the conclusions are not to be accepted on grounds of experimenter bias, is as follows. Given two groups of students, select

the group whose performance is poorer, (even if the difference is not statistically significant) and in a time period of one week reverse the relative standings to a statistically significant level using any grading plan by means of expectation and perhaps even overt encouragement of the lower group. The only guideline is that the better group in no way be threatened or overtly discouraged. The possibility of such an experiment succeeding seems negligible.

Implications for Teachers

If attrition and experimenter bias can be dismissed as primary causative factors, then the results of the experiment can be accepted at face value. Although no teacher would deliberately use a grading plan which causes students to learn less, many teachers have been using plans which allow credit for incorrect responses. The use of such plans seems most often to reflect a lack of understanding of the relationship between the grading variable and teaching. If reinforcement is being considered, the grading plan is based on the oversimplified analysis that high scores reinforce only what should be reinforced. Unfortunately such analyses do not give careful consideration to the type of behavior such grading plans encourage. In grading a student's paper, a teacher gives one numerical mark. This mark is either reinforcing or it is not. When the mark given is high enough to be "satisfactory," the teacher is reinforcing what is wrong as well as

what is right. With partial credit grading, because students could achieve scores which they perceived as satisfactory without having mastered the concepts and principles involved, some could be misled into believing they were ready to learn later portions of the course. In fact, they were not.

Learning psychologists will not be surprised at another example of the importance of feedback in determining what is learned. Because marks given to students can affect their behavior, a teacher must guard against reinforcing some students when they have learned insufficiently. For this reason the teacher should not grade according to the method which is most convenient. The teacher ought to consider carefully the concepts which are necessary for the student to master and devise a grading plan which gives credit only when the student's response indicates mastery of these concepts and withholds credit for anything less. This is especially important in accounting, and is presumably desirable in other cumulative courses. While PC grading gave Group P students credit for each account answered correctly, NPC grading required Group N students to analyze the entire transaction correctly. When points are given for each account answered correctly, it is possible for the student to achieve a score which he might perceive as adequate without analyzing any of the given transactions correctly. Under NPC grading this possibility does not exist. Because the student graded under the PC plan can achieve a grade which reinforces

without having mastered the concepts being studied, he can be deceived into believing that improvement is not needed. NPC grading is less likely to be reinforcing to the student when the need for improvement exists.

How general are the conclusions about grading which can be drawn from this experiment? Although only two sections of students were involved, it seems reasonable to conclude that experimental results would apply generally to accounting subject matter. It could be inferred that some counterpart to NPC grading would apply to other subject matter if two conditions were met. First, the subject matter is cumulative and the remediation of early defects is increasingly important for later success. Second, there is a meaningful unit, and if credit is awarded for less than this meaningful unit, then inadequate performance is being rewarded, diminishing chances for later success. While it is possible that a similar grading plan might affect learning of a subject matter not fulfilling the stated conditions in a similar way, no conclusions can be drawn without further research.

Miscellaneous items. Prior to the experiment the concern had been expressed that the students might discover and be outraged that two different grading treatments were being applied to the same performance. This fear was exaggerated. After homework problems were collected, they were corrected by the graders according to the appropriate grading plan. Students were allowed to keep these papers. This could have

allowed the students to discover the different treatments. However, this discovery did not occur, and no student ever questioned the grading of his or any other student's papers. That the students did not discover the differing treatments may be due to the possibility discussed in Chapter II - that students often do not examine the papers returned to them.

Another noteworthy factor is the average to above-average re-enrollments for both treatment groups. These re-enrollments indicate that neither treatment group had strikingly adverse feelings toward the two grading plans. It is even possible that NPC grading was an important cause of satisfaction. The possibility for discovery of different treatments might have been enhanced if one group were very dissatisfied.

Analysis and Further Research

There are several areas for further analysis and research suggested by the study just completed. One possible response to those who are convinced either that partial credit grading is superior to no partial credit grading or that the method of grading makes no difference is for such persons to replicate the study. The investigator's opinion is that the results would still favor the no partial credit plan even if there were an expectation by the investigator that partial credit scoring would lead to better performance. There are

reasons to believe that, subject to the conditions mentioned previously, the effects are general in significance; and the investigator's own assessment is that the impact of partial credit grading is so clear that it is ethically questionable to perform more experiments in which one treatment group is deliberately placed at a disadvantage. (Of course, this would not be true for the experimenter who was convinced of his ability to refute the evidence reported in this study.)

A reasonable question to investigate is whether a grading system which allowed partial credit but required a high mark to pass would be as effective as the NPC system was in the completed study. It might be argued that since there is little difference in the message sent between a partial credit and a no partial credit plan when a high score is required for the student to pass, it is possible that there would be little difference in the performance of the two groups. Care would have to be taken that the examinations were difficult enough so that high marks were not easily attainable, and each examination should test material presented earlier as well as current material. This procedure would guarantee that students would be given some credit on later examinations for correcting their earlier mistakes. It would also be necessary that the number of points required for passing under the PC plan be equivalent to the perceived threshold of passing under the NPC plan. It could be argued, however, that the NPC group's performance might still be

superior because the NPC plan calls attention to what is wrong in a more effective way. It is also possible that NPC grading creates a situation where study is reinforced because the gain is more dramatic and easily perceived. Under PC grading even if a student performs significantly better, the relatively small point gain may be perceived as insignificant; under NPC grading the point gain is larger. Whether or not NPC grading has these advantages is a matter for further investigation. A possible difficulty in using a high pass partial credit plan is the risk that many students would abandon the course because they feared they might be unable to achieve the high score needed to pass. Again, further research can answer this question.

For the individual who is unwilling to use a no partial credit plan, perhaps because he fears student criticism relative to the way in which teachers of other sections are grading, a bonus plan might be an appropriate compromise. This plan might involve the use of partial credit in conjunction with bonuses which increase as the number of items answered correctly increases. For example, assume an examination in which the student is required to analyze transactions, five involving changes to only two accounts, the other five involving changes to three accounts (comparable to Examination 3 in Appendix B). If partial credit were used, the students could be awarded two points for each account and amount answered correctly. (For the five transactions involving two

accounts, the total possible point value is twenty points; for the other five transactions the total possible point value is thirty points, a combined total of fifty points.) One possible bonus plan awards additional point credit, the amount of which increases as the number of items answered correctly increases. For the examination described above a student scoring between two and 20 points receives a 10 point bonus; between 22 and 30 points, a 20 point bonus; between 32 and 40 points, a 30 point bonus; between 42 and 46, a 40 point bonus; and between 48 and 50, a 50 point bonus. A second bonus plan might work by establishing different multipliers which increased as the number of points achieved increased.* For the sample examination the score of a student receiving between two and twenty points would be multiplied by a factor of 1.1; between 22 and 30 by 1.3; between 32 and 40 by 1.5; between 42 and 46 by 1.8; between 48 and 50 by 2. Either plan is differentially rewarding and emphasizes the importance of the cumulative nature of accounting subject matter, allowing substantially more credit for perfect or near perfect performance. The bonus plan is an alternative for those who believe that there will be too many student complaints if no partial credit is used; it is a way of giving some credit for the things that are recognized in partial credit grading while reducing the risk of a

* Both types of bonus plans were suggested by work done by Dr. Frank A. Singer and reported in (ED 082 291) p. B 6.

student interpreting unsatisfactory performance as satisfactory.

The completed experiment involved only two groups of students taught by the investigator because of limited resources. While the investigator is convinced that results similar to those that occurred in this research would occur if the experiment were replicated with larger sample sizes, one opportunity for further research is such a replication.

The research mentioned above might also include in its design a survey of the student participants' attitudes toward the two grading plans.

Of course, the teacher has many important choices to make. The results of the just completed experiment have shown that it is possible for a teacher to be totally conventional in all respects but choice of grading plan and still be making a decision which affects crucially the amount his students will learn.

What other teacher decisions are also important? The completed study has confirmed that students are affected by the type of feedback they receive. The amount of feedback most certainly is also important, but the question of how much feedback is optimal remains to be resolved. Another factor to be considered in the design of instruction is variability among students. In view of the fact that different students learn at different rates, it undoubtedly would prove more effective to allow those students who seemingly

have mastered certain principles and concepts to go on in the course while requiring those students whose examination performance indicates a lack of principle and concept mastery to restudy the given topic and then retake the examination and perform well enough to indicate they are capable of mastering new material. Some may argue that present academic environments would not allow the implementation of a plan so drastically different from those currently used in most settings. However, because teachers have many significant choices to make, experiments such as the one just completed must be continued in order that teachers have information gathered scientifically as a decision making base.

Footnotes

¹Thomas L. Good and Jere E. Brophy, "Analyzing Classroom Interaction: A More Powerful Alternative," Educational Technology (October, 1971), pp. 38-9.

²Robert Rosenthal, Experimenter Effects in Behavioral Research (Appleton-Century-Crofts, 1966), pp. 410-11.

³Ibid., p. 306.

⁴Good and Brophy, p. 39.

⁵Ibid.

⁶Rosenthal

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APPENDIX A

Titles and Descriptions of the Chapters in Johnson and Gentry's Finney and Miller's Principles of Accounting Covered during the Semester

<u>Chapter</u>	<u>Title and Description</u>
1	Accounting as an Information System: In this chapter basic terms are defined and the student is introduced to transaction analysis.
2	Introduction to Accounting Theory: In this chapter the emphasis is on analysis of transaction taking into consideration the going-concern assumption and the fiscal-period assumption.
3	Income Measurement: The emphasis in this chapter is on income measurement with special emphasis on the timing of revenue and expense recognition.
4	Traditional Record Keeping Procedures: In this chapter the recording process is illustrated from journalization to the trial balance.
5	The Accounting Cycle: This chapter details those steps and procedures from the closing of the books to final statement preparation.
6	Monetary Assets - Cash and Investment in Securities: In this chapter the topics of bank reconciliation, petty cash, and marketable securities are discussed.
8	Monetary Assets - Receivables: The accounting for accounts and notes receivable is discussed in detail.
9	Inventory Costing and Control: Inventory methods are discussed with the emphasis on inventory valuation methods.
10	Long-Lived Assets: A study of the procedures for the acquisition, depreciation or depletion, and disposal of long-lived assets.
11	Liabilities: This chapter is a study of the accounting procedures for recording of short and long term liabilities.

APPENDIX B

Examinations 1 through 6 and Grading Instructions for
for Examinations 1 through 6

Examination 1

Required: Analyze the following events of the Watergate Moving Company on the transaction worksheet provided. Transaction Q has been entered on the worksheet.

- Q. A group of individuals invest \$35,000 cash and receive capital stock in exchange.

- A. Two trucks each costing \$8,000 are purchased from the Springfield Truck Sales Co. Made a \$4,000 downpayment and gave a 7%, 90-day note for the remainder.

- B. Issued shares of stock at par to Mr. J. Dean for land valued at \$12,000 and a building valued at \$37,000.

- C. Having moved furniture from Springfield to Amherst, we accept M. Mitchell's \$255 check as full payment.

- D. Purchased, on account, \$177 of office supplies.

- E. The valuables of Mr. Paul Goldworth were moved from Houston to Holyoke for \$2,005. Collected \$605 in cash; balance to be received in 60 days.

- F. \$40 worth of bookkeeping forms purchased in D are returned and our check is sent for the balance owed.

- G. Rented from Xerox Co., a copier. Paid the two-year rent of \$1,500 today.

- H. Computed and paid this month's salaries of \$815.

- I. Received a gasoline bill for this month's gas from the Pacific Oil Company in the amount of \$605 to be paid before the end of next month.

- J. A \$1,000 promissory note is signed and given to Jaxon, Inc. for a typewriter, desk, and chair.

Examination 2

A. Below is a list of account balances for the Connally Auto Company as of December 31, 1971.

Accounts Receivable.....	\$ 4,500	Office Equipment.....	\$ 1,700
Advances from Customers.....	1,000	Prepaid Rent.....	-0-
Bank Loans Outstanding.....	4,000	Rent.....	-0-
Capital Stock.....	10,000	Rent Owing.....	-0-
Cash.....	5,000	Retained Earnings.....	4,800
Cost of Sales.....	-0-	Sales.....	-0-
Due to Creditors.....	5,200	Sales Commissions.....	-0-
Merchandise Inventory.....	9,500	Salesmen's Advances.....	-0-
Notes Receivable.....	-0-	Savings Bank Deposits.....	4,000
		Supplies on Hand.....	300

B. Enter these opening balances on the transaction worksheet and analyze the transactions for the month of January, 1972 presented below.

- Two cars, each costing \$3,000, are purchased on account from Ford Motor Company.
- Paid the Local Realty Company the next two years' rent on the showroom, \$4,200.
- a. A green stationwagon is sold for \$4,950 cash to Mr. Cond.
b. The above stationwagon cost \$2,900.
- Charged our purchase of a new \$135 adding machine and \$20 worth of paper, pencils, and pens.
- An additional \$4,000 is borrowed at 6% from the First National Bank.
- Returned the equipment (not the supplies) acquired in transaction 4 and sent our check for the balance owed.
- Our check of \$2,900 was sent to Ford Motor Co. in payment of their invoice of December 21, 1971.
- Received a \$1,500 check from Mr. Goldcoin and accepted his 6%, 60-day note of \$1,200 in settlement of his account.
- Order from Ford Motor Company a blue and white station-wagon for Mr. J. Alch. Accept Mr. Alch's \$400 deposit.
- Mr. J.B. Walker earned \$510 in commissions in January for which a check is now issued.

Examination 3

The following transaction has been entered correctly in the transaction analysis form on the next page.

Example O. Settled a \$600 note and \$3 interest with our check.

REQUIRED: For each of the following, indicate the immediate actual effect on the accounts and accounting elements of Ace Consulting Co. (Do not use a method that anticipates what will be reported at the end of the period.) See the example. Begin each analysis beside its number. Use only the lines needed.

1. Completed a \$600 consulting assignment and accepted a \$1,000 machine in exchange. We paid the difference to the supplier.
2. A \$500 dividend was declared and paid to the stockholders.
3. Government bonds having a market value of \$3,000 are purchased.
4. Collected \$7,200 for a three-year assignment as an advisor to J. Smith. Will start the first of 12 quarterly consultations next week.
5. Bi-weekly salaries paid as follows:

Henry Forbes	\$225.00
Alice Cook	\$250.00
6. Collected \$150 from W. Horton of which \$10 is interest on the note receivable due today.
7. Land of Pilgrim's Pride was purchased for \$6,000---cash \$1,000, balance borrowed on mortgage at First National Bank.
8. A 5%, 90-day note of Elsworth Little was accepted as full payment upon completion of \$600 worth of services.
9. Returned equipment and recovered our 80% downpayment and took credit for the \$1,000 unpaid balance we had recorded at purchase.
10. Supplies costing \$24 were sold for \$30 cash.

Use the following code: + increase \$ _____, - decrease \$ _____

Account Title l acct. per line	Total Assets	Total Liabilities	Owners' Equity		
			Inc. or Rev.	Expense	Owners' Capital
0. Cash	+ _____ - 603	+ _____	+ _____	+ _____	+ _____
Notes Payable	+ _____	+ _____ - 600	+ _____	+ _____	+ _____
Interest Expense	+ _____	+ _____	+ _____	+ _____ - 3	+ _____
1.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
2.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
3.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
4.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____

Use the following code: + increase \$ _____ , - decrease \$ _____

Account Title l acct. per line	Total Assets	Total Liabilities	Owners' Equity		
			Inc. or Rev.	Expense	Owners' Capital
5.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
6.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
7.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
8.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
9.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____

Use the following code: + increase \$ _____ - decrease \$ _____

Account Title l acct. per line	Total Assets	Total Liabilities	Owners' Equity		
			Inc. or Rev.	Expense	Owners' Capital
10.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____

Examination 4
Part I

The following transaction has been entered correctly in the transaction analysis form on the next page.

Example O. Settled a \$600 note and \$3 interest with our check.

REQUIRED: For each of the following, indicate the immediate actual effect on the accounts and accounting elements of Ace Consulting Co. (Do not use a method that anticipates what will be reported at the end of the period.) See the example. Begin each analysis beside its number. Use only the lines needed.

1. A travel advance of \$300 was made to C. Regal, our salesman.
2. Office furniture costing \$12,000 was purchased. A 25% downpayment is made and a 6%, 60 day note is signed on the remainder. (The equipment has a useful life of 10 years with no scrap value.)
3. Received a \$300 payment in full for merchandise sold. \$160 related to goods sold, recorded, and billed last month, while the remainder related to sales made (but not previously billed or recorded) this month.
4. Purchased a 2 year fire insurance policy at \$120 per year.
5. Purchased land valued at \$2,500 by issuing capital stock with a par value of \$2,200 and giving merchandise costing \$300.

Use the following code: + increase \$ _____, - decrease \$ _____

Account Title l acct. per line	Total Assets	Total Liabilities	Owners' Equity		
			Inc. or Rev.	Expense	Owners' Capital
0. Cash	+ - 603	+ -	+ -	+ -	+ -
Interest Expense	+ -	+ -	+ -	+ - 3	+ -
Notes Payable	+ -	+ - 600	+ -	+ -	+ -
1.	+ -	+ -	+ -	+ -	+ -
	+ -	+ -	+ -	+ -	+ -
	+ -	+ -	+ -	+ -	+ -
2.	+ -	+ -	+ -	+ -	+ -
	+ -	+ -	+ -	+ -	+ -
	+ -	+ -	+ -	+ -	+ -
3.	+ -	+ -	+ -	+ -	+ -
	+ -	+ -	+ -	+ -	+ -
	+ -	+ -	+ -	+ -	+ -
4.	+ -	+ -	+ -	+ -	+ -
	+ -	+ -	+ -	+ -	+ -
	+ -	+ -	+ -	+ -	+ -

Use the following code: + increase \$ _____, - decrease \$ _____

Account Title l acct. per line	Total Assets	Total Liabilities	Owners' Equity		
			Inc. or Rev.	Expense	Owners' Capital
	+ _____	+ _____	+ _____	+ _____	+ _____
5.	- _____	- _____	- _____	- _____	- _____

	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____

	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____

Examination 4
Part II

The following adjusting entry has been correctly analyzed in the transaction analysis form on the next page.

Example a.

Supplies on Hand	Supplies Expense
40	(a) 10
10 (a)	

REQUIRED: For each of the following, indicate the immediate actual effect on the accounts and accounting elements of the Haskins Company. Begin each analysis beside its number. Use only the lines needed.

b.

Interest Income	Interest Receivable
42	(b) 6
6 (b)	

c.

Accrued Advertising Expense	Advertising
50 (c)	20
	(c) 50

d.

Prepaid Rent	Rent
1600	(d) 400
400 (d)	

e.

Admission Revenue	Deferred Revenue- Season Tickets
1000	(e) 170
170 (e)	550

f.

Fuel Cost	Inventory of Fuel
205	(f) 75
75 (f)	

9.

Modeling Fees
(g) 25 | 90
|

Fees for Future Sitzings
25 (g)
|

Use the following code + increase \$ _____ , - decrease \$ _____

Account Title l acct. per line	Total Assets	Total Liabilities	Owners' Equity		
			Inc. or Rev.	Expense	Owners' Capital
a. Supplies on Hand	+ _____ - 10	+ _____	+ _____	+ _____	+ _____
Supplies Expense	+ _____	+ _____	+ _____	+ _____ - 10	+ _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
b.	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
c.	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
d.	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
e.	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____
	+ _____	+ _____	+ _____	+ _____	+ _____
	- _____	- _____	- _____	- _____	- _____

Use the following code: + increase \$ _____ - decrease \$ _____

Account Title l acct. per line	Total Assets	Total Liabilities	Owners' Equity		
			Inc. or Rev.	Expense	Owners' Capital
f.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
g.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____

Use the following code: + increase \$ _____ - decrease \$ _____

Account Title l acct. per line	Total Assets	Total Liabilities	Owners' Equity		
			Inc. or Rev.	Expense	Owners' Capital
f.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
g.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____

- H. Purchased on account an adding machine costing \$160 and paper, pencils, and pens for \$22.
- I. Paid the \$75 bill for taxes which was received last month.
- J. Declared and paid a dividend to shareholders. Instead of cash, RCA stock which had cost \$700 is given.
- K. An advance of \$35 is received today on appraisal work to be performed next year.

ASSETS

LIABILITIES

270 (A)

Accounts Receivable
Bal. 140

OWNERS' EQUITY

Revenue or Income

Expense

Permanent

--

(A) 270

Capital Stock
2000 Bal.

--

Advertising
Bal. 12

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Examination 6

The accounts listed below make up a complete ledger for the Dean Consulting Company. The balances in the accounts are the results of all external transactions of this firm through August 31,--, the date this company has chosen for the annual closing of its books.

Accounts Receivable.....	\$ 3,000	Interest Expense.....	\$ 40
Accrued Interest Receivable.....	-0-	Interest Payable.....	-0-
Accrued Wages.....	-0-	Land.....	2,020
Accumulated Depreciation-		Notes Payable.....	1,500
Building.....	10,000	Notes Receivable.....	100
Accumulated Depreciation-		Office Equipment.....	1,500
Office Equipment.....	250	Office Supplies.....	100
Building.....	72,000	Prepaid Interest Expense.....	-0-
Capital Stock.....	50,000	Property Taxes.....	1,800
Cash.....	9,600	Rental Income.....	-0-
Deferred Fee Income.....	-0-	Retained Earnings.....	10,036
Depreciation.....	-0-	Rentals Received in Advance.....	3,600
Due to Suppliers.....	3,000	Supplies Expense.....	-0-
Fees Earned.....	17,900	Wages.....	6,150
Interest Earned.....	24		

REQUIRED:

1. Enter the titles and balances of the above accounts (as someone has done for eight accounts). The balances are normal for the indicated class of accounts. Each account must be placed in the section established for its class. You will have a complete ledger when you have done it correctly.

2. Record the proper debits and credits for each of the following adjustments in the ledger you established in 1, above. **BE SURE TO KEY** the amounts you enter for an adjustment with the letter which identifies it here (no keying, no credit).

- (a) The secretary's salary is \$150 weekly, and will next be paid on Friday, September 3, for the five day week then ended.
- (b) About \$30 worth of office supplies are estimated to be on hand.
- (c) Notes Payable are as follows:
 - I. \$500 to Carson Equipment, Inc. on which the interest paid when due will include \$7 which has accumulated through August 31.
 - II. \$1,000 due the Third National Bank on a non-interest-bearing note. The bank gave the company only \$970 for this six month note on May 31, and the \$30 difference was debited to interest expense at this time.
- (d) \$1 of interest has accrued on the note receivable from a client.
- (e) Certain annual fees, called retainers, are received on a calendar year basis. The \$9,600 of retainers collected in January is now part of the Fees Earned balance.

(f) On August 1, part of the building was rented to a small retailer.
At that time the annual rental of \$3,600 was received.

(g) The annual depreciation has been computed to be:

Building-----	\$1,200
Office Equipment-----	\$ 150

ASSETS

Accounts Receivable

Bal. 3000

Building

Bal. 72000

Cash

Bal. 9600

Land

Bal. 2020

Office Supplies

Bal. 100

LIABILITIES

Notes Payable

Bal. 1500

|

|

|

|

|

|

|

|

|

OWNERS' EQUITY

Revenue or Income	Expense	Permanent
<hr/> 	<p data-bbox="797 532 890 564">Wages</p> <hr/> <p data-bbox="713 564 890 600">Bal. 6150</p> 	<p data-bbox="1200 532 1427 564">Capital Stock</p> <hr/> <p data-bbox="1353 564 1532 600">Bal. 50000</p>
<hr/> 	<hr/> 	<hr/>
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Scoring Instructions

PC Grading Rules

NPC Grading Rules

Examination 1

For each transaction a point was given when the appropriate account was identified correctly and placed in the appropriate section of the segregated worksheet that identified its class, and a second point was given when the appropriate amount appeared under the account title.

For each transaction a point was given only when all the accounts involved were identified correctly as to class and amount.

Examination 2

A. A point was given for each account title and amount placed in the section of the worksheet that identified the account's class.

A. Two points were given only when all accounts and amounts were placed in the section of the worksheet that identified the accounts' classes.

B. For the transactions the awarding of points was the same as in Examination 1.

B. For each transaction, the awarding of points was the same as in Examination 1.

Examination 3

For each transaction a point was given for each account identified correctly and a point was given when the proper amount was placed in the column that identified the account's class.

For each transaction a point was given only when the transaction was analyzed correctly in its entirety on the transaction worksheet.

Examination 4

Same as Examination 3

Same as Examination 3

Examination 5

I. A point was given for each account placed in the appropriate section of the segregated ledger with the account's balance on the appropriate side of the account.

II. For each transaction a point was given for each account identified correctly and a second point was given when the proper amount was placed on the appropriate side of the account affected.

Examination 6

Same as Examination 5

I. Two points were given only if all the accounts and account balances were placed in the proper section of the segregated ledger.

II. For each transaction a point was given only when the transaction was analyzed correctly in its entirety in the segregated ledger.

Same as Examination 5

APPENDIX C

Behavioral Objectives of Examinations 1 through 6

Examination 1

Given a series of business transactions, the student will recognize the effect that each transaction has on the accounts and account amounts. This objective will be achieved when the student writes the account titles in the proper section of the segregated transaction worksheet and for each account places the correct amount with the appropriate sign under the appropriate account title.

Examination 2

Part A

Given a list of account balances the student will be able to identify each as to its account class. The objective will be achieved when the student writes each account title with its amount in the proper section of the segregated ledger.

Part 3

Same as Examination 1

Examination 3

Given a list of business transactions, the student will recognize the effect that each transaction has on the accounts and account amounts. This objective will be achieved when the student writes the account titles and for each account places the correct amount in the appropriate column that identifies each account's class.

Examination 4

Part I

Same as Examination 3

Part II

Given a series of postings to "T" accounts adjusting in nature, the student will recognize the effect that each posting has on the accounts and account amounts. The objective will be achieved when the student writes the account titles and for each account places the correct amount in the appropriate column that identifies each account's class.

Examination 5

Part I

Given a list of account balances the student will be able to identify each as to account class and be able to identify the normal balance for each account. This objective will be achieved when the student writes each account title above the "T" account in the appropriate section of

the segregated ledger and places the account balance in the proper side of the account.

Part II

Given a series of business transactions, the student will recognize the effect that each transaction has on the accounts and the account amounts and will determine the debits and credits that need to be made. This objective will be achieved when the student posts the proper amount on the proper side of the "T" account of the accounts affected in each transaction.

Examination 6

Part I

Same as Examination 5, Part I

Part II

Given a series of transactions adjusting in nature, the student will recognize the effect that each adjustment has on the accounts and the account amounts and will determine the debits and credits that need to be made. This objective will be achieved when the student posts the proper amount on the proper side of the "T" account of the accounts affected in each transaction.

APPENDIX D

Parts I through IV of the Post-Test
and the Behavioral Objectives
of Parts I through IV

Part I

Here are a number of transactions:

Example: 0. Settled a \$500 note and \$5 interest with our check.

1. We exchange our services (and cash) for 3 new \$70 sewing machines. After deducting our \$110 fee, we pay the difference by check.

2. Prepaid 5 months of newspaper advertising. The rate is \$140 per month.

3. Accepted Ms. Janice Elliot's 6%, 60 day promissory note in full of account she owed. Face value of the note is \$2000.

4. Donated a \$25 savings bond (\$-cost, \$18.75) to local mission drive. (Our bonds are made out to "bearer.")

5. Purchased two identical machines for \$3000--our \$450 check is a downpayment.

6. Returned a snow-thrower to Huddleston Bros. Cancelled a \$150 balance due and collect a refund of our 25% downpayment.

7. Received a \$200 payment in full for consulting services. \$120 related to services performed, recorded, and billed last month, while the remainder related to services performed (but not previously recorded or billed) this month.

REQUIRED: For each transaction indicate the immediate actual effect (whatever might be recorded) on the accounts and accounting elements. See the example that appears on the next page. Begin each analysis where the corresponding number appears. Use as many lines as you need for each event.

Use the following code: + increase \$_____ - decrease\$_____

ACCOUNT TITLE l acct. per line	Total Assets	Total Liabilities	Owners' Equity	
			Inc. or Rev.	Expense Owners' Capital
0 Cash	+ 505	+ _____	+ _____	+ _____
Notes Payable	+ _____	+ 500	+ _____	+ _____
Interest	+ _____	+ _____	+ _____	+ 5
1.	+ _____	+ _____	+ _____	+ _____
	+ _____	+ _____	+ _____	+ _____
	+ _____	+ _____	+ _____	+ _____
2.	+ _____	+ _____	+ _____	+ _____
	+ _____	+ _____	+ _____	+ _____
	+ _____	+ _____	+ _____	+ _____
3.	+ _____	+ _____	+ _____	+ _____
	+ _____	+ _____	+ _____	+ _____
	+ _____	+ _____	+ _____	+ _____
4..	+ _____	+ _____	+ _____	+ _____
	+ _____	+ _____	+ _____	+ _____
	+ _____	+ _____	+ _____	+ _____

ACCOUNT TITLE l acct. per line	Total Assets	Total Liabilities	Owners' Equity	
			Inc. or Rev.	Expense Owners' Capital
5.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
6.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
7.	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____
	+ _____ - _____	+ _____ - _____	+ _____ - _____	+ _____ - _____

Part II

Required: Indicate the immediate, actual effect (both before and After Closing) on the following (independent) errors on each of the accounting elements described in the column headings below. Use the following code:

+ overstated - understated 0 no effect

Error	Accounting Elements					
	Net Income	Total Revenue	Total Expense	Total Assets	Total Liabilities	Total Owner's Equity
Example: A failure to record an investment by the owners.	0	0	0	-	0	-
Case 1. Failure to record sale of service to a customer.						
Case 2. Revenue is credited when cash is collected from a credit customer.						
Case 3. Failure to record the declaration and payment of a dividend.						
Case 4. Failure to record the interest accrued on a note receivable.						
Case 5. Failed to adjust prepaid expense account, so it remained overstated by \$250.						
Case 6. Failure to record the issuance of a note in settlement of an account payable						
Case 7. A customer's advance payment on merchandise to be delivered next period was journalized as follows: Dr. Cash 20 Cr. Sales 20						
Case 8. Salary expense was charged for an advance to an employee.						

Part III

All adjustments are accomplished by one of the following six pairs of changes:

1. an asset is increased and a revenue (or income) account is increased
2. a liability is increased and expense is increased
3. an asset is decreased and expense is increased
4. a liability is decreased and a revenue (or income) account is increased
5. an expense is decreased and an asset is increased
6. a revenue (or income) account is decreased and a liability is increased

Here are several examples of completed adjustments. Indicate the combination of changes, from the above list of which it is an example.

CIRCLE the appropriate number.

Example

<u>Deferred Insurance Premiums</u>	<u>Expired Insurance</u>	1	2	3
690 (ex) 420	(ex) 420			(3)
		4	5	6

A. <u>Unearned Rent</u>	<u>Rent Earned</u>	1	2	3
(a) 300 1300	(a) 300			
		4	5	6

B. <u>Interest Receivable</u>	<u>Interest Income</u>	1	2	3
(b) 20	(b) 20			
		4	5	6

C. <u>Accrued Fees</u>	<u>Fees Earned</u>	1	2	3
(c) 730	22365 (c) 730			
		4	5	6

D. <u>Interest Expense</u>	<u>Prepaid Interest Expense</u>	1	2	3
73 (d) 51	(d) 51			
		4	5	6

E. <u>Depreciation</u>	<u>Accumulated Depreciation</u>	1	2	3
(e) 25	335 (e) 25			
		4	5	6

F. <u>Accrued Advertising Expense</u>	<u>Advertising</u>	1	2	3
(f) 15	400			
	(f) 15	4	5	6

G. <u>Fee Income</u>	<u>Unearned Fees</u>	1	2	3
(g) 20	(g) 20			
320		4	5	6

H. <u>Accrued Property Taxes</u>	<u>Property Taxes</u>	1	2	3
(h) 55	(h) 55			
		4	5	6

I. <u>Inventory of Fuel</u>	<u>Fuel Costs</u>	1	2	3
(i) 75	.215 (i) 75			
		4	5	6

J. <u>Admissions Revenue</u>	<u>Deferred Revenue- Season Tickets</u>	1	2	3
2000	(j) 80			
(j) 80	520	4	5	6

Part IV

- I. This is a transaction which has been entered in untitled T-accounts on the next page:

Transaction A:

Computed and paid the monthly commissions of \$111.

- (a) Find the title of the two accounts which should be used for it in the following list, and write each title on the appropriate account.

Accounts Receivable.....	\$200	Land.....	\$300
Accumulated Depreciation		Notes Payable.....	\$100
Office Equipment.....	\$ 50	Notes Receivable.....	\$-0-
Capital Stock.....	\$400	Office Equipment.....	\$200
Cash.....	\$300	Office Supplies Used.....	\$ 12
Clients' Advances.....	\$ 30	Prepaid Interest.....	\$-0-
Due to Creditors.....	\$145	Rent.....	\$150
Employee Advances.....	\$-0-	Retained Earnings.....	\$ 75
Fees Earned.....	\$900	Salesmen's Commissions....	\$450
Gain on the Sale of Land....	\$ 12	Supplies on Hand.....	\$ 15
Interest Expense.....	\$ 5	Taxes.....	\$ 80

- (b) Enter the balances of these two accounts as given in the above list.

- (c) Enter the titles and balances of the accounts listed (as someone has done for Accounts Receivable). The balances are normal for the indicated class of account. Each account must be placed in the section established for its class. You will have a complete ledger when you have done it correctly.

- II. Record the proper debits and credits for each of the following transactions in the ledger you established in I, above. If you feel none of the account titles given are appropriate, you can invent an appropriate one. BE SURE TO KEY the amounts you enter for a transaction with the letter which identifies here (no keying, no credit). See I, again, for the example given (A).

- B. Performed \$75 of services for a client. A \$10 advance was received last month and the client is billed for the difference.
- C. Sold land costing \$160 for \$220 accepting a 5%, 90-day note as full payment.
- D. Received a \$53 money order from Art Day in full payment for the work for which we billed him last month.
- E. Performed a consulting job accepting $\frac{1}{2}$ payment of \$90 and billing the client for the balance.
- F. Payment on account, \$56.

- G. Paid \$50 advances to each of 3 salesmen who will have these amounts deducted from the future commissions they will earn.
- H. Collected the account of Fran Fletcher, who had purchased our used equipment in March, \$100.
- I. Acquired a \$110 adding machine by issuing shares of capital stock at par.
- J. A \$50 note payable is paid, with \$2 interest thereon.
- K. Collected \$24 in advance from Elliot Stowe for appraisal work to be performed next period.

Revenue or Income

OWNER'S EQUITY

Expense

Permanent

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(A) 111 |
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Behavioral Objectives of the Post-Test

- Part I Given a list of business transactions, the student will recognize the effect that each transaction has on the accounts and account amounts. This objective will be achieved when the student writes the account titles and for each account places the correct amount in the appropriate column that identifies each account's class.
- Part II Given a list of descriptions of errors the student will recognize the effect on every accounting element of the balance sheet and income equations (Assets - Liabilities = Owners' Equity; Revenue - Expense = Net Income). This objective will be achieved when the student selects the appropriate symbol.
- Part III Given a series of postings to "T" accounts adjusting in nature, the student will recognize the effect that each posting has on the account classes. The objective will be achieved when the student circles the number that identifies the statement that describes the effect.

Part IV Part I. Given a list of account balances the student will be able to identify each as to account class and be able to identify the normal balance for each account. This objective will be achieved when the student writes each account title above the "T" account in the appropriate section of the segregated ledger and places the account balance on the proper side of the account.

Part II. Given a series of business transactions, the student will recognize the effect that each transaction has on the accounts and the account amounts and will determine the debits and credits that need to be made. This objective will be achieved when the student posts the proper amount on the proper side of the "T" account of the accounts affected in each transaction.

APPENDIX E-1

Item Analysis of the Post-Test
Using NPC Grading Rules

Part I

Item	Point Value	Mean Group P	Mean Group N	t	Level of Sign.
1	1	.8000	.8928	1.0389	NS*
2	1	.8572	.8215	.3821	NS
3	1	.4858	.6172	.9705	NS*
4	1	.1429	.0715	.9325	NS
5	1	.5143	.6429	1.0381	NS*
6	1	.5143	.7858	2.3670	.025*
7	1	.3715	.6785	2.5541	.01*

* Group N's performance exceeds that of Group P

Part II

(I)ncome Effect: (B)alance Sheet Effect

Item	Point Value	Mean Group P	Mean Group N	t	Level of Sign.
1-I	1	.6858	.7858	.9065	NS*
1-B	1	.3143	.6429	2.9271	.005*
2-I	1	.3143	.6072	2.4174	.01*
2-B	1	.1815	.4643	2.5743	.01*
3-I	1	.6572	.4286	1.8550	.05
3-B	1	.6286	.7500	1.0500	NS*
4-I	1	.5715	.6429	.5794	NS*
4-B	1	.2858	.7500	4.1483	.0005*
5-I	1	.2572	.2858	.2531	NS*
5-B	1	.1715	.5000	2.8832	.005*
6-I	1	.6000	.6072	.0576	NS*
6-B	1	.2858	.3515	.6030	NS*
7-I	1	.3143	.5715	2.1061	.025*
7-B	1	.9150	.3572	1.6774	.05*
8-I	1	.2858	.2143	.6563	NS
8-B	1	.2571	.2500	.0678	NS

Part III

Item	Point Value	Mean Group P	Mean Group N	t	Level of Sign.
A	1	.6571	.6428	.1181	NS
B	1	.9715	1.0000	1.0145	NS*
C	1	.3715	.5715	1.6108	NS*
D	1	.8285	.9285	1.2474	NS*
E	1	.8285	1.0000	2.6911	.005*
F	1	.7428	.8215	.7597	NS*
G	1	.8285	.9285	1.2474	NS*
H	1	.7143	.8957	1.8569	.05*
I	1	.8000	.9285	1.5434	NS*
J	1	.6785	.6857	.0605	NS*

Part IV

Item	Point Value	Mean Group P	Mean Group N	t	Level of Sign.
A	1	.3143	.5357	1.8051	.05*
B	1	.6285	.5715	.4602	NS
C	1	.5715	.8215	2.2600	.025*
D	1	.7715	.7857	.1359	NS*
E	1	.5715	.5000	.6641	NS
F	1	.6715	.5715	.6956	NS
G	1	.4857	.5000	.1127	NS*
H	1	.8000	.7500	.4710	NS
I	1	.7429	.7500	.0104	NS*
J	1	.6857	.7143	.2465	NS*
K	1	.7143	.8315	1.0183	NS*

APPENDIX E-2

Item Analysis of the Post-Test
Using PC Grading Rules.

Part I					
Item	Point Value	Mean Group P	Mean Group N	t	Level of Sign.
1	6	5.6000	5.6787	.0572	NS*
2	4	3.7115	3.6429	.6907	NS
3	4	2.8286	3.1429	1.0801	NS*
4	4	1.5715	2.0358	1.6847	.05*
5	6	4.8572	5.3929	1.9834	.05*
6	6	4.5143	5.1786	1.4746	NS*
7	6	4.1429	5.0000	2.2280	.025*

*Group N's performance exceeds that of Group P

Part II

(I)ncome Effect; (B)alance Sheet Effect

Item	Point Value	Mean Group P	Mean Group N	t	Level of Sign.
1-I	3	2.5715	2.7858	1.4618	NS*
1-B	3	2.1143	2.5358	2.3134	.025*
2-I	3	2.0571	2.2143	.6501	NS*
2-B	3	1.5429	2.0357	2.0347	.025*
3-I	3	2.4000	2.2143	.8283	NS
3-B	3	2.5143	2.6429	.7101	NS*
4-I	3	2.4286	2.5371	.3211	NS*
4-B	3	2.0000	2.6429	3.3122	.001*
5-I	3	1.8571	1.8929	.1671	NS*
5-B	3	1.8571	2.4286	3.0174	.005*
6-I	3	2.4000	2.4643	.3138	NS*
6-B	3	1.6857	1.7857	.4042	NS*
7-I	3	1.8000	2.1071	1.1041	NS*
7-B	3	1.4571	1.7500	1.0351	NS*
8-I	3	1.8286	1.8571	.1254	NS*
8-B	3	1.6000	1.7500	.5931	NS*

Part IV

Item	Point Value	Mean Group P	Mean Group N	t	Level of Sign.
A	20	17.0286	17.8214	.8898	NS*
B	6	5.0000	4.7143	.6786	NS
C	6	4.9429	5.5000	1.5967	NS*
D	4	3.3429	3.4643	.3999	NS*
E	6	3.1715	1.1786	.0231	NS*
F	4	3.1715	1.1786	.0231	NS*
G	4	3.1429	2.7857	1.1286	NS
H	4	3.4857	3.4643	.0816	NS
I	4	3.6000	3.6429	.2234	NS*
J	6	5.0571	5.4643	1.0827	NS*
K	4	3.4286	3.5714	.5518	NS*

APPENDIX F

Orientation Test (OT) and Post-Test (PT) Rankings of Group P Students When Groups P and N are Combined

OT RANK	PT RANK ¹	OT RANK	PT RANK
63	58*	37	11*
62	63	31	34
61	49*	28	41
60	42*	27	29
59	53*	24	42
58	33*	22	19*
55	18*	21	16*
54	20*	19	52
53	23*	18	46
52	11*	14	4*
50	40*	14	16
44	59	12	32
44	26*	8	6*
44	9*	8	7*
41	28*	7	2*
41	24*	5	8
39	15*	1	2
39	10*		

A * indicates a student who ranked lower on the post-test than on the orientation test.

¹For both the post-test and the orientation test the student with the lowest score was assigned the Rank 1.

Orientation Test (OT) and Post-Test (PT) Rankings of
Group N Students When Groups P and N are Combined

OT RANK	PT RANK	OT RANK	PT RANK
55	48*	28	55
55	56	26	26
51	42*	24	34
44	29*	22	49
44	33*	19	34
44	59	16	37
41	57	16	22
37	51	13	4*
35	59	10	24
35	46	10	1*
33	53	5	37
33	39	4	11
32	42	2	20
30	62	2	14

